DEPT of PUBLIC WORKS

ANNUAL REPORT 77/78

COMMONWEALTH OF MASSACHUSETTS

ANNUAL REPORT

JULY 1, 1977 THROUGH JUNE 30, 1978

COMMONWEALTH of MASSACHUSETTS

MICHAEL S. DUKAKIS
Governor

FREDERICK P. SALVUCCI
Secretary of
Transportation & Construction

DEPARTMENT OF PUBLIC WORKS

JOHN J. CARROLL
Commissioner

ROBERT T. TIERNEY
Chief Engineer

The Commonwealth of Massachusetts
Executive Office of Transportation and Construction
Department of Public Works
Office of the Commissioner
100 Nashua Street, Boston 02114

November, 1978

His Excellency Governor Michael S. Dukakis
Frederick P. Salvucci,
Secretary of Transportation and Construction
and the Great and General Court of the
Commonwealth of Massachusetts

I am transmitting herewith our Department's Annual Report for the fiscal year ended June 30, 1978. During the period covered by this report, the Department advertised over $166,000,000 in highway construction and related contracts. This amount, added to our three previous outstanding years, exceeds $650,000,000 - the most productive 4 years in the Department's history.

During the past four years the Massachusetts Department of Public Works made a noteworthy transition from the emphasis almost entirely on highway construction to a truly multi-modal transportation agency. This is best reflected by the awarding in 1978 of contracts for railroad rehabilitation, bikepaths, MBTA related projects, car pool lanes and the purchase of a South Shore commuter boat. This reflects well for the versatility of the Department and its employees.

Sincerely,

JOHN J. CARROLL
COMMISSIONER

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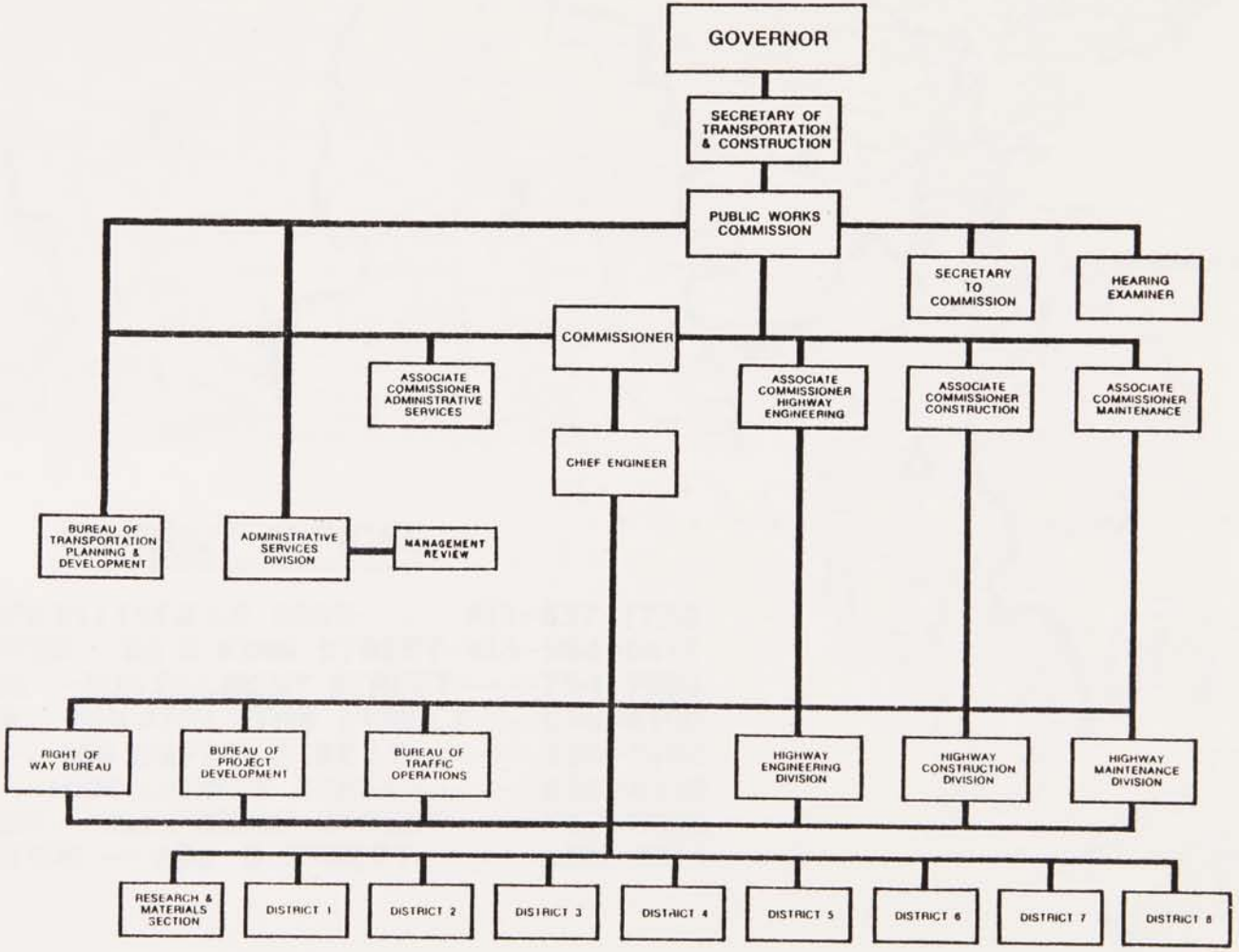
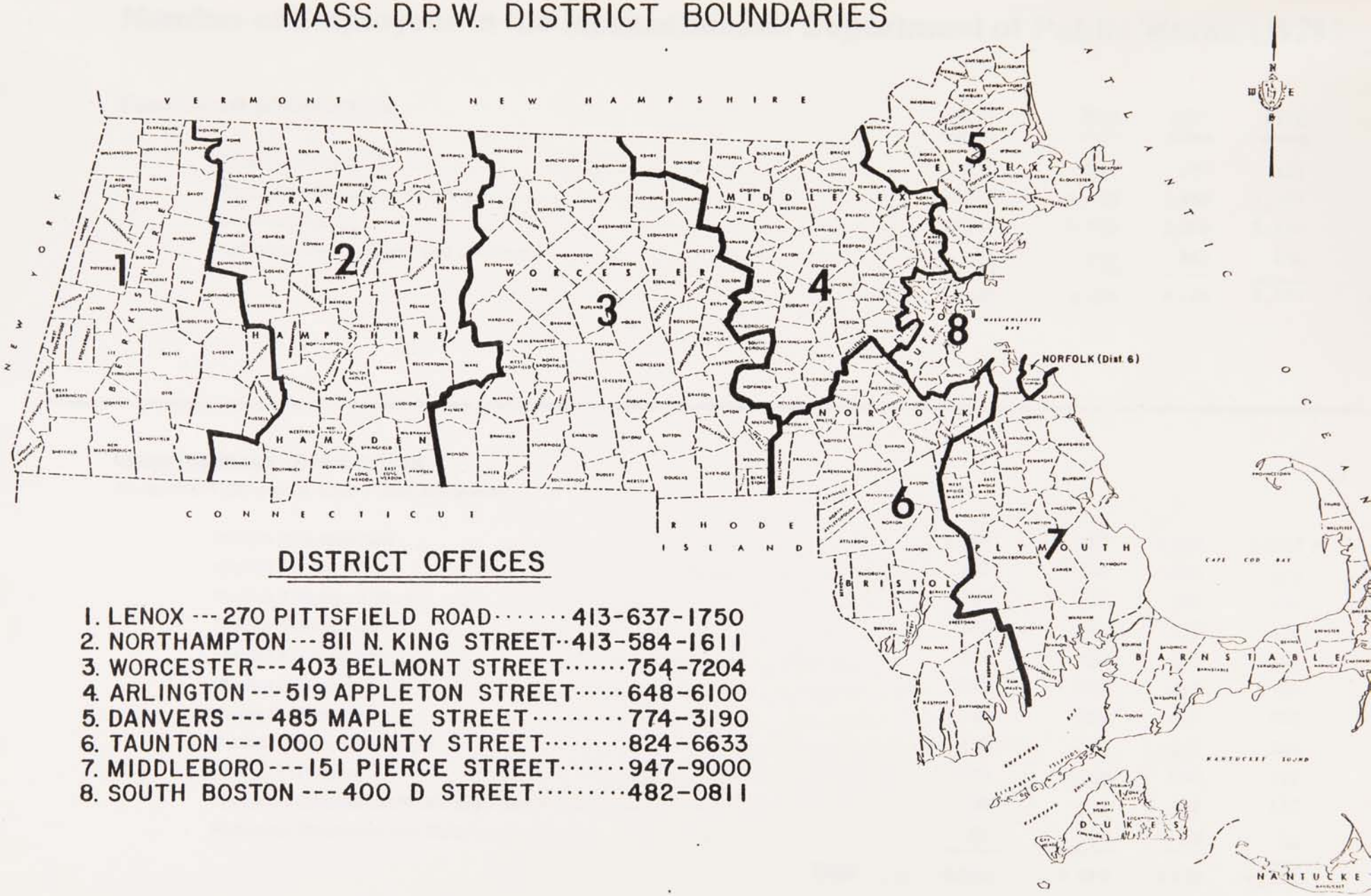
Massachusetts Department of Public Works



MASS. D.P.W. DISTRICT BOUNDARIES



DISTRICT OFFICES

1. LENOX --- 270 PITTSFIELD ROAD 413-637-1750
2. NORTHAMPTON --- 811 N. KING STREET .. 413-584-1611
3. WORCESTER --- 403 BELMONT STREET 754-7204
4. ARLINGTON --- 519 APPLETON STREET 648-6100
5. DANVERS --- 485 MAPLE STREET 774-3190
6. TAUNTON --- 1000 COUNTY STREET 824-6633
7. MIDDLEBORO --- 151 PIERCE STREET 947-9000
8. SOUTH BOSTON --- 400 D STREET 482-0811

Number of Employees in the Massachusetts Department of Public Works (1978)

Functional Distribution

	1975	1976	1977	1978
Policy and Planning	212	202	224	181
Construction and Engineering	1,620	1,435	1,458	1,352
Maintenance	2,327	2,179	2,094	2,132
Administrative Support and Overhead	400	347	362	436
Total	4,559	4,163	4,138	4,101

Geographical Distribution

(excludes Waterways & Solid Waste Divisions)

Boston Headquarters	1,162	1,040	1,050	1,042
District 1 (Lenox)	227	211	210	219
District 2 (Northampton)	354	327	327	323
District 3 (Worcester)	439	416	412	386
District 4 (Arlington)	453	408	410	409
District 5 (Danvers)	394	368	350	354
District 6 (Taunton)	633	588	575	581
District 7 (Middleborough)	440	391	384	368
District 8 (Boston)	255	230	239	232
Wellesley (Maintenance and Sign Shop)	135	124	122	127
Wellesley (Research and Materials)	67	60	59	60
Total	4,559	4,163	4,138	4,101

SUMMARY OF DPW

HIGHWAY CONSTRUCTION AND MAINTENANCE

CALENDER YEAR	ACCELERATED HIGHWAY PROGRAM ACTS	$ VALUE OF CONST. PROJECTS ADV.	# LANE MILES STATE HWYS. MAINTAINED
1960	$ 86,000,000	$ 75,000,000	7049
1961	90,000,000	73,000,000	7243
1962	110,000,000	79,000,000	7522
1963	125,000,000	86,000,000	8133
1964		73,000,000	8300
1965	320,000,000	62,000,000	8614
1966		90,000,000	8443
1967	300,000,000	101,000,000	8754
1968		63,000,000	8936
1969	260,000,000	173,000,000	9266
1970		63,000,000	9395
1971		79,000,000	9530
1972	561,000,000	143,000,000	9780
1973		92,000,000	10550
1974		136,000,000	11438
1975	353,000,000	187,000,000	11566
1976		182,000,000	11600
1977	589,900,000	143,000,000	11600
1978		160,000,000 est.	11600

5 YEAR SUMMARY (AVERAGE/YEAR)

	CONSTRUCTION PROJECTS ADV. ($)	# LANE MILES MAINTAINED
1961-1965	75 million	8,000
1966-1970	100 million	9,000
1971-1975	130 million	10,000
1976-1978	160 million (2 yrs)	11,600

PROJECTS ADVERTISED

(Fiscal Year 1978)

July	1977	$12,887,250.
August	1977	12,063,741.
September	1977	35,042,457.
October	1977	24,517,744.
November	1977	21,929,000.
December	1977	3,594,526.
January	1978	13,380,605.
February	1978	5,173,643.
March	1978	2,696,382.
April	1978	6,892,842.
May	1978	11,505,321.
June	1978	16,558,623.
	TOTAL	166,242,134.

MASSACHUSETTS FEDERAL HIGHWAY ADMINISTRATION
APPORTIONMENTS

Category	Fiscal Yr. 1976	Fiscal Yr. 1977	Fiscal Yr. 1978	1979
Interstate	99,094,511	1,440,925	37,957,335	69,072,387
Interstate Gap Closing	-	-	16,623,649	30,250,680
Interstate Resurfacing	-	-	2,098,652	2,033,683
Primary Rural	7,702,920	-	-	-
Consolidated Primary	-	20,276,525	20,805,314	-
Secondary Rural	3,710,370	3,221,459	3,465,127	-
Urban System	23,760,384	23,944,099	23,944,098	-
Urban	9,248,193	-	-	-
Priority Primary	5,952,685	-	-	-
Hwy. Planning Research (1½%)	2,117,850	744,409	1,597,371	1,543,503
MTA Planning (½%)	922,320	945,715	982,429	563,150
High Hazard Locations	1,626,225	-	-	-
Elim. Rds. & Obstacles	1,626,225	-	-	-
High Hazard-Rd.side Obstacles	-	2,723,279	2,721,033	-
Rail-Hwy. Crossings (on sys)	1,294,977	2,458,456	2,497,303	-
Rail-Hwy Crossings (off-sys)	-	1,475,074	1,498,382	-
Safer Rds. Demo.	2,102,907	-	-	-
Off System Rds.	1,349,555	-	-	-
Safer Rds.-Off Sys.Rds.	-	3,323,025	3,158,226	-
TOTAL	$160,509,122	$60,552,966	$117,448,919	$103,463,403
Allocations				
Pavement Markings	380,325	764,537	787,722	
Spcl. Br. Repl. thru 1975	1,650,649	114,536	7,651,409	
Econ. Growth ctr. dev'l Hwy. thru 1974	831,940	436,393		

BUREAU OF TRANSPORTATION PLANNING AND DEVELOPMENT

BUREAU OF TRANSPORTATION PLANNING AND DEVELOPMENT

PLANNING ADMINISTRATION

HIGHWAY DATA COLLECTION AND PLANNING SERVICES

- Inventory and Statistics
- Traffic Volume Counting
- Highway Functional Classification
- Highway Needs Identification
- Mapping
- Defense Bridge and Critical Highway Facilities Record

DATA ANALYSIS AND COMPUTER SERVICES

- Census Data Development
- Data File Management and Display
- Traffic Analysis and Forecasting
- Motor Vehicle and Fiscal Data Reporting
- Regional Data and Modelling Assistance
- Statewide Modelling and Planning Applications
- Eastern Massachusetts Area Transportation Studies

REGIONAL TRANSPORTATION PLANNING

PROGRAM DEVELOPMENT

CAPITAL EXPENDITURE AND PROJECT PROGRAMMING

PLANNING ADMINISTRATION

The Bureau of Transportation Planning and Development of the Massachusetts Department of Public Works was established in 1964 under Section 3A of Chapter 16 of the General Laws. The executive and administrative head of the Bureau is the Director of Transportation Planning and Development.

This Bureau serves as the principal source of transportation planning in the Commonwealth and conducts research, surveys, demonstration projects, and studies in cooperation with the Federal government, other governmental agencies and appropriate private organizations and is responsible for the continual preparation of comprehensive and coordinated transportation plans and programs. In addition, it maintains a data bank of all available transportation information statistics for reference use by all public agencies in the Commonwealth.

The Administration Section is comprised of three units with responsibilities as follows:

The Administrative Unit provides the necessary secretarial and clerical support for the Bureau;

The Budget Management Unit is in charge of budget preparation and verifying expenses;

The Contract Payment Unit initiates contract documents and monitors expenditures.

HIGHWAY DATA COLLECTION AND PLANNING SERVICES

Inventory and Statistics

The Road Inventory Program provides continually updated administrative, geometric, and structural roadway data to aid development of short- and long-range transportation plans. This is achieved through the collection and analysis of data on the approximate 33,500 miles of roadway open to public travel in Massachusetts.

A continuous inventory file update procedure was established and implemented utilizing the Department's district offices as well as the cities and towns. Information is gathered throughout the year regarding changes in the roadway network and forwarded to the Bureau each year via the district offices. The updates are reviewed and necessary changes are made to the data file. Revised printouts are then returned to the district offices and cities and towns for their use in the following year's update.

A computerized reporting system was implemented which allows streamlined reporting of mileage statistics to be made on an annual basis to the Federal Highway Administration.

Information was provided upon request to various public agencies, local communities, businesses and citizens.

HIGHWAY DATA COLLECTION AND PLANNING SERVICES

Traffic Volume Counting

An important responsibility of the Bureau is to maintain statewide surveillance of traffic activities on various roadways and develop travel statistics from the gathered data. This task is accomplished by observing traffic volumes and patterns in approximately 2200 locations throughout the State, as follows: 26 permanent counting stations, 113 control stations (monthly), 1000 coverage counts (48 hour counts), 1000 special counts (48 hour counts), 50 turning movement and/or classification studies.

This demand for traffic data requires considerable effort on the part of the maintenance personnel at the Wellesley Shop to keep all the traffic recording equipment in service and Boston personnel in the processing and analysis of data. To assist in this effort a new traffic tape to card translator and 25 traffic recorders were purchased this past fiscal year to replace aging equipment.

The voluminous traffic data generated by this activity is computerized and provides traffic information in a variety of formats.

During this year the Traffic Volume Booklet and Traffic Flow Map for the year 1977 were published and distributed to state agencies, and made available to the general public.

Another important responsibility of this unit is to participate in numerous highway design contracts and studies by supplying peak hour volumes, truck factors, and other needed traffic data. A study was just completed in the Salem-Peabody area in which a series of roadways were monitored.

HIGHWAY DATA COLLECTION AND PLANNING SERVICES

Highway Functional Classification

The Bureau conducted a reevaluation of previously developed vehicle miles of travel for the past five-year period 1972 to 1976. The results of this analysis are contained in the report "Massachusetts Annual Vehicle Miles of Travel (AVMT) Analysis," dated June 1978. This report, which was distributed to various State and Federal agencies, also included revised travel and accident (TA-1) tables for the years 1973, 1974, 1975 and 1976.

Another accomplishment was the completion of the 1977 TA-1 table which employs data from the Federal-aid and functional classification systems, as well as data from the Traffic Counting Section, for reporting purposes to the Federal Highway Administration.

During the year, minor revisions and updates have been made to the highway functional classification system and the F. A. system in response to requests from local communities.

Information was provided upon request regarding Federal-aid systems and boundaries, functional classification and vehicle mile of travel estimates to various public agencies, local communities, etc.

HIGHWAY DATA COLLECTION AND PLANNING SERVICES

Highway Needs Identification

The objective of the Highway Needs Identification Program is the development of procedures and a supportive data base for locating and identifying physical deficiencies on our Federal-aid highway network including the Interstate, other Primary, Secondary and Urban systems. Each route's performance can then be compared with all other routes in terms of performance rating categories of condition, safety and service. This will provide a systematically applied technical rating system for priority setting and construction scheduling for highway improvements, and will facilitate identification of those Federal-aid routes and systems where maximum benefits can be derived for each highway dollar spent for the community as well as the travelling public.

Accomplishments during the past year include completion of the National Highway Inventory and Performance Study (NHIPS) and its submission to the Federal Highway Administration. This work effort required the completion of 4100 worksheets encompassing 6441 miles of road (100% sample) covering the Federal-aid Interstate, other Primary, Secondary and Urban Systems. Administrative, geometric and appraisal data were gathered from the Road Inventory data file.

Work began on expanding the sample on all arterial and collector routes to 100%, as well as changing data already coded as determined from road inventory updates received from our District offices as well as the cities and towns.

HIGHWAY DATA COLLECTION AND PLANNING SERVICES

Highway Needs Identification (continued)

Work continued on re-establishing the NHIPS data file into a format which will provide information required in the areas of deficiency analysis and needs identification for the Department and local communities.

HIGHWAY DATA COLLECTION AND PLANNING SERVICES

Mapping

The objective is to provide maps for use in transportation and related activities by both the public and private sectors.

During the year most of the mylars in District Five and District One were updated.

Maps of the State are available on the following scales: 1"=1000' for urban areas; 1"=2000', 1"=5280' for regions; a map covering the area inside Route 128; a statewide map at 1"=3 miles; an index sheet; and a statewide photo index map.

Numerous maps and information concerning maps and air photos covering all of the maps available through BTP&D were provided to public agencies, organizations, businesses and citizens throughout the year.

Maps are supplied at cost to the general public and are provided free to other state agencies within limits. Total map sales this period amounted to $2,689.

The wide-range demand for these maps included requests from Federal, State, Regional and local agencies, educational institutions, and special purpose use, such as sales, promotion, cycling, animal disease control, and geographical research.

HIGHWAY DATA COLLECTION AND PLANNING SERVICES

Defense Bridge and Critical Highway Facilities Record

The purpose of this task is to provide the U. S. Department of Defense and other agencies with highway ramp geometrics and structural capacity data for bridge facilities throughout the Commonwealth along with the establishment of a spider network of highways that act as the Defense Route network for the State.

During the fiscal year the Highway Defense Record was updated and computerized using a new format.

Better liaison was established between the Department and those agencies involved in national defense.

A new Highway Defense Route Map and log was prepared and sent to Washington along with ramp sketches showing roadway geometrics at all crossings on the network.

This task will continue year to year but should no longer involve any major work.

DATA ANALYSIS AND COMPUTER SERVICES

Census Data Development

This unit provided technical assistance and coordinated data collection and systems development with state agencies, Regional Planning Agencies (RPA's), cities and towns, federal agencies, organizations, businesses and educational institutions.

RPA participation in all ten Standard Metropolitan Statistical Areas (SMSA's) with Federal Joint Statistical Agreement funding for the Correction, Update and Extension (CUE) program continued to be coordinated for use of the 1970 U. S. Census GBF/DIME file data of the 1980 U. S. Census.

This unit continued to make journey-to-work data available to many agencies, both public and private.

DATA ANALYSIS AND COMPUTER SERVICES

Data File Management and Display

During Fiscal Year 1978, technical assistance in computer processing and program development was provided in-house as well as to the Regional Planning Agencies (RPA's), Office of State Planning (OSP) and various other agencies.

The traffic volume and other inventory files were updated, and development continued on improved display techniques for inventory data to assist transportation and comprehensive planning activities.

Technical assistance in computer processing, both direct and through remote terminal, was provided to the RPA's, OSP and other agencies.

Many meetings were attended with in-house and other agency persons to encourage development of a universal data base system, especially as it would tie into our road inventory and statewide network bases.

Records for the National Highway and Improvement Study were entered into a file and processed with various programs. After this processing, a tape was submitted to FHWA for their use. A slightly modified file was created for the use by the Bureau in various ways.

Records for The Mileage Facilities Report were created by processing the NHIPS files with the inventory files and two tapes containing this data were forwarded to two different divisions of FHWA.

The inventory file was processed to develop VMT data for DEQE.

DATA ANALYSIS AND COMPUTER SERVICES

Traffic Analysis and Forecasting

During Fiscal Year 1978, this unit responded to twenty-six project requests, in addition to the Interstate Cost Estimate. These requests consisted of relocation, reconstruction, pavement overlays, safety, and substandard bridge projects as well as proposed solid waste sites. Present and future traffic projections, along with the appropriate traffic design criteria, were supplied for most of the project requests.

Staff members of this unit attended approximately sixty meetings during the year with representation from other Department units, consultants, staff members of RPA's and other state agencies.

This unit reviewed and responded to twelve draft project reports.

In the review of consultant contract proposals, meetings were usually held with the consultants to firm up areas of responsibility for the various work elements.

Miscellaneous output from this unit consisted of answering requests for traffic data from citizens, consultants and state and local agencies, as well as holding discussions with business people regarding future traffic projections at possible business sites, and the growth rate potential for future years.

DATA ANALYSIS AND COMPUTER SERVICES

Motor Vehicle and Fiscal Data Reporting

Data was collected and prepared for the (15) PR series of forms for reporting motor vehicle statistics, motor fuel consumption and receipts and state highway expenditures and receipts to the Federal Highway Administration. This material was submitted during various months of the year, and showed statistical and financial data in a variety of categories for the year 1977.

Also, 75% completed during fiscal 1978 was the Local Road and Street Finance Form PR 535. This consists of 43 forms exhibiting data from 351 cities and towns. These communities are broken down into several sub-groups, as well as 11 SMSA regions comprised of 177 cities and towns used for reporting purposes.

Still being studied is the feasibility of computerization of the PR 535 as a means of cutting down on the required time in computation, assemblage and reporting. However, regardless of the technique used, improved cooperation is needed in reporting from cities and towns.

Some discrepancies arose during the year relative to motor fuel consumption, registrations and license statistics that are so very necessary in producing TA-1 tables, vehicle miles of travel, etc.

Discussions were held with FHWA Statistical Section, State Department of Corporations and Taxation and the Registry of Motor Vehicles. As a result of this dialogue, the in-State discrepancies were resolved. The methodology of the tables produced in the "Highway Statistical Reports" by FHWA was forwarded to us.

DATA ANALYSIS AND COMPUTER SERVICES

Motor Vehicle and Fiscal Data Reporting (continued)

This was necessary in order that we could follow the reasoning why the various statistics sent by us to FHWA were shown modified in these statistical reports. It appears these differences have been resolved for future years.

Many statistics are kept and information received from other agencies and State Departments, such as Mass. Turnpike, Massport, MBTA, etc., are not required to be reported to FHWA. However, they are assembled and utilized for various transportation planning purposes.

DATA ANALYSIS AND COMPUTER SERVICES

Regional Data and Modelling Assistance

During Fiscal Year 1978, technical assistance and training was provided to all Regional Planning Agencies (RPA's).

Personnel from two additional RPA's were trained in utilization of the District Computer Terminal Network and three required retraining due to personnel shifts. Now all urban RPA's with the exception of the Berkshire County Regional Planning Commission have this analysis capability because they have their own in-house connection to the Department computer and the Old Colony Planning Council has recently obtained a computer terminal for their office so as to eliminate the need to use the district's terminal.

Assistance was provided to all RPA's, having new form "3C" contracts in force, to develop milestones for contract payment for task 2.1, Transportation Systems Plans - Modelling Effort. Further, revisions and adjustments were prepared to these lists as it became apparent that some of the items were unrealistically budgeted. Work has already begun on preparation of the next generation of unified work programs for the next two year period.

BTP&D staff were assigned to carry out certain work items under RPA task 2.1 so as to maintain schedule and assist RPA's over difficult items.

All Corridor Planning Studies prepared by the RPA's during the year were reviewed and the Montachusett and Berkshire Regional Planning Studies were closely monitored, and assistance provided as needed.

DATA ANALYSIS AND COMPUTER SERVICES

Statewide Modelling and Planning Applications

During Fiscal Year 1978, development work on the Statewide Network and a variety of computer programs continued.

All requested computer traffic assignments and analyses were completed, and subsequent use of them by other BTP&D sections and consultants was closely monitored.

Computer analyses other than traffic assignments were also provided for a variety of transportation planning projects. This includes statistical, environmental, socio-economic and other categories.

Technical assistance has been provided to Federal, State and local agencies and educational institutions in support of transportation planning research and development efforts.

A variety of new computer programs including CAPII, SPSS, and the UTPS 7-7-77 release were placed in service at the MDPW Computer Center for use in transportation planning activities. Also, it was necessary to expend considerable effort in debugging many of the new and existing programs caused by modifications to the DPW computer facility.

The Statewide Network project is now approximately 75% complete, with the entire Road Inventory Classified System available in machine readable and plotable form. Editing of node numbers, coordinates, and town numbers is approximately 95% complete with editing and in some cases recording of the remaining data fields about 75% complete. Network logic checks are being undertaken

DATA ANALYSIS AND COMPUTER SERVICES

Statewide Modelling and Planning Applications (continued)

through the RPA's use of the Statewide Network data in the development of their regionalized networks. We are notified of any difficulties encountered by them, and corrections are made in our data file.

DATA ANALYSIS AND COMPUTER SERVICES

Eastern Massachusetts Area Transportation Studies

The A. M. Voorhees consultant contract to provide 1975 base year model assessment of four "Eastern Massachusetts" RPA's was completed. We are awaiting the final paper work to terminate this project. The products are being utilized in all of the subject RPA's.

REGIONAL TRANSPORTATION PLANNING

In accordance with Federal rules and regulations, multi-modal transportation plans and programs are developed by each of the Commonwealth's Regional Planning Agencies (RPA's) through the statewide Comprehensive, Cooperative and Continuing (3C) Transportation Planning Process. This process involves a variety of agencies and disciplines to ensure that transportation plans and programs are consistent with the comprehensive development plans of the regions.

Major work efforts in each region were directed towards carrying out those planning activities necessary to obtain Federal certification. Each urbanized region in the Commonwealth received certification by the Federal Highway and Urban Mass Transportation Administrations.

Unified planning work programs were developed for each region. These describe all transportation and transportation-related planning activities anticipated to be undertaken within a region during the following two-year period. They also describe the institutional relationships and responsibilities for conducting those activities.

Transportation plans were prepared in each region to delineate long-range transportation needs. In addition, a Transportation Systems Management Element (TSME), which addresses short-range needs through more efficient use of existing transportation facilities and resources, and a Transportation Improvement Program (TIP) for each region were developed. The TIP is a staged multi-year program of transportation improvement projects and includes

REGIONAL TRANSPORTATION PLANNING
(continued)

an annual element which lists projects proposed for implementation during the first program year.

Liaison and technical assistance were provided to all regions.

PROGRAM DEVELOPMENT

Utilizing input from all affected agencies, guidelines for the development of regional transportation plans were produced and steps taken to insure that all such plans conform to the guidelines.

A special interagency task force was formed to coordinate the development of the transportation portions of the State Implementation Plan (SIP) regarding air quality for the designated carbon monoxide and ozone non-attainment areas. The task force assisted the Metropolitan Planning Organizations (MPO's) and the Department of Environmental Quality Engineering (DEQE) in fulfilling 1979 SIP revision requirements and developing air quality planning tasks for inclusion in Unified Work Programs.

The Boston-to-Cape Cod Bikeway was completed and numerous community and inter-regional bikeway projects were moved through the planning process into the development stage. In addition, the BTP&D continued to coordinate statewide bikeway planning activities and disseminated bikeway planning information as needed.

Throughout the year, guidance and support was given the RPA's in the development, conduct and completion of Corridor Planning Studies and other special studies such as the Route I-495 Growth Study.

During the year, the Masspool Ridesharing Program was placed under the direction of the 3C Planning Liaison Section. Much progress was achieved in establishing new ridesharing programs at large employment facilities and improving existing ones. Concentration of effort was in the Boston and Pioneer Valley Air Quality Control Regions although work continued on a statewide basis. All Federal

PROGRAM DEVELOPMENT
(continued)

and State facilities located in Boston Proper were organized for the conduct of ridesharing programs.

A personalized ridesharing service for individuals was instituted at BTP&D headquarters that successfully matched approximately 350 of 600 requests received.

A pilot program, aimed at establishing community-based ridesharing programs to complement the existing employer-based programs, was begun.

A concerted effort was made to promote vanpooling throughout the Commonwealth which resulted in an increase in the number of identifiable company-sponsored vanpools. An in-house study was begun to investigate the possibilities of instituting third party vanpool operations in Massachusetts.

CAPITAL EXPENDITURE AND PROJECT PROGRAMMING

The major responsibilities of this section are operational in nature and involve programming all Federal-aid projects, issuing all Department engineering work orders (EWO's) which include the cost account numbers for all Massachusetts Department of Public Works (MDPW) activities, and managing those accounts.

The "Program of Projects to be Advertised," which includes all projects programmed for advertising during calendar years 1978 and 1979 was developed and distributed.

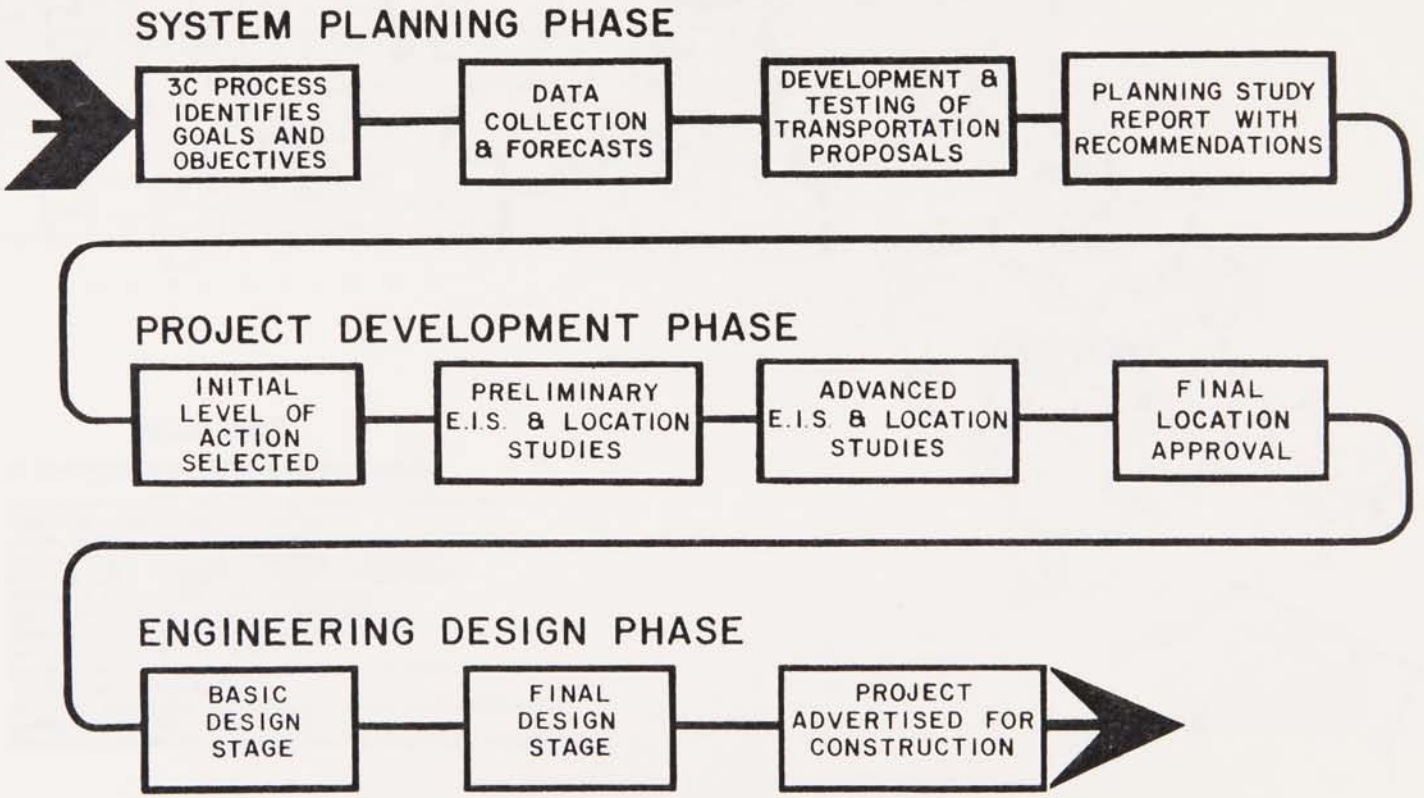
The Project Information System was reprogrammed and expanded to over 1500 entries, including all active MDPW projects.

The FY 1979 Transportation Improvement Program (TIP) for each Regional Planning Agency was coordinated and reviewed.

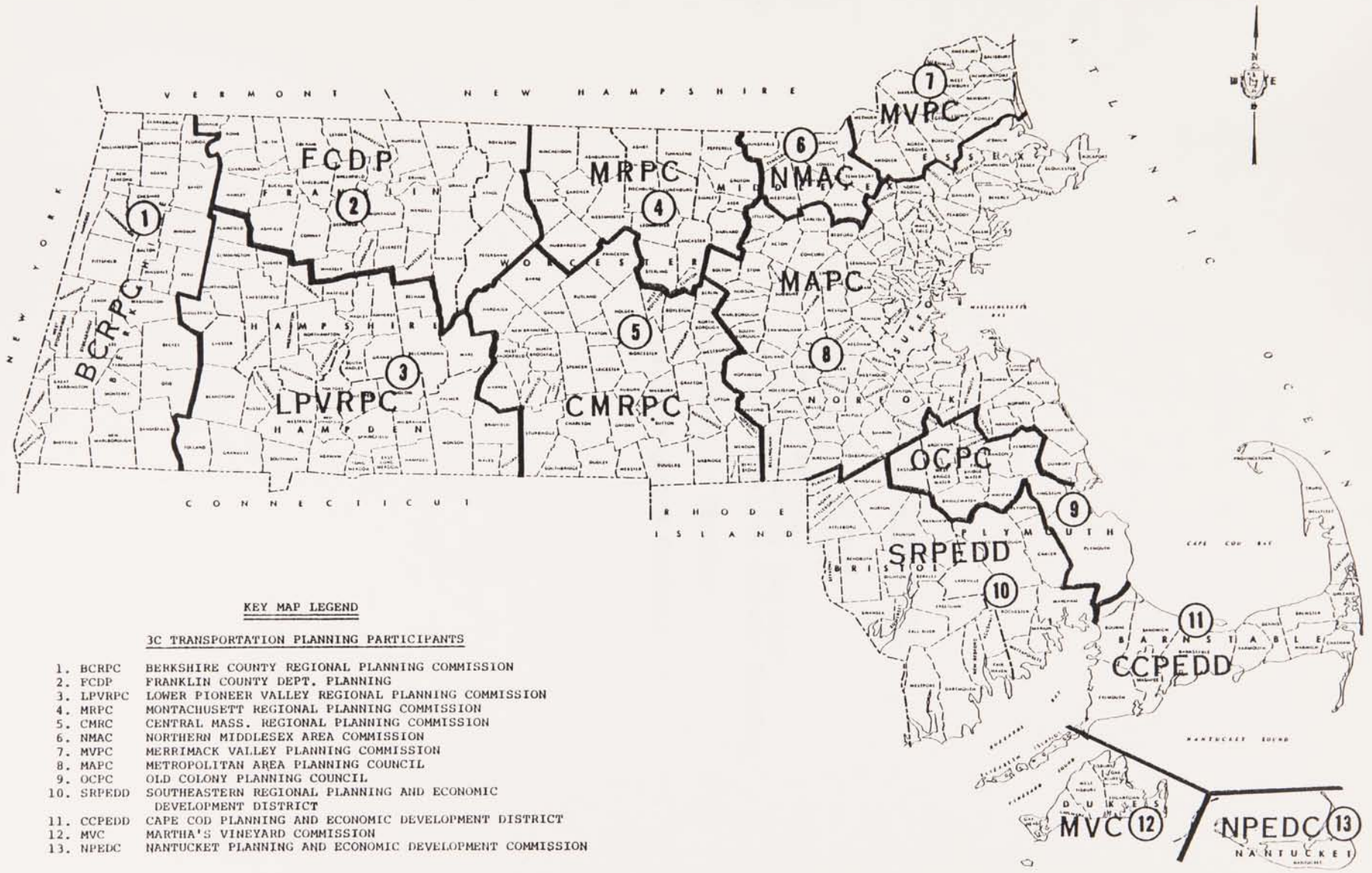
The '105' Federal-aid Program for FY-79 was prepared for submission to the Federal Highway Administration.

The "State Aid to Municipalities" publication was completely rewritten and distributed to all the cities and towns.

STEPS IN THE DEVELOPMENT OF A TRANSPORTATION PROJECT IN MASSACHUSETTS



REGIONAL PLANNING AGENCIES



KEY MAP LEGEND

3C TRANSPORTATION PLANNING PARTICIPANTS

1.	BCRPC	BERKSHIRE COUNTY REGIONAL PLANNING COMMISSION
2.	FCDP	FRANKLIN COUNTY DEPT. PLANNING
3.	LPVRPC	LOWER PIONEER VALLEY REGIONAL PLANNING COMMISSION
4.	MRPC	MONTACHUSETT REGIONAL PLANNING COMMISSION
5.	CMRC	CENTRAL MASS. REGIONAL PLANNING COMMISSION
6.	NMAC	NORTHERN MIDDLESEX AREA COMMISSION
7.	MVPC	MERRIMACK VALLEY PLANNING COMMISSION
8.	MAPC	METROPOLITAN AREA PLANNING COUNCIL
9.	OCPC	OLD COLONY PLANNING COUNCIL
10.	SRPEDD	SOUTHEASTERN REGIONAL PLANNING AND ECONOMIC DEVELOPMENT DISTRICT
11.	CCPEDD	CAPE COD PLANNING AND ECONOMIC DEVELOPMENT DISTRICT
12.	MVC	MARTHA'S VINEYARD COMMISSION
13.	NPEDC	NANTUCKET PLANNING AND ECONOMIC DEVELOPMENT COMMISSION

BUREAU OF PROJECT DEVELOPMENT

Location and Surveys
- Location Section
- Survey Section
- Geodetic Survey Section
- Photogrammetric Survey Section

Environmental Section

Special Projects Section

BUREAU OF PROJECT DEVELOPMENT

The Bureau of Project Development is responsible for transportation projects and related activities when the Bureau of Transportation Planning and Development has assigned priorities to them under their "system planning phase". Its work continues the "3C" planning process, a continuing, cooperative and comprehensive effort, using full citizen participation to develop projects from preliminary engineering through basic design, complying with applicable Federal and State environmental laws.

The Bureau is responsible for the study of transportation alternatives within a corridor location. It develops the various alternatives within the corridor using the "no build" option as a basis for comparison.

The Bureau prepares preliminary plans and profiles with cost estimates, and develops the socio-economic and environmental impacts for each alternative. The study produces a "recommended alternative" and an Environmental Report. After a Public Hearing, if the project does not have major opposition, a Basic Design Report is completed with a Final Environmental Report. The project, if approved by Federal and State officials, then can proceed into the Final Design phase.

The Bureau has six major sections:

Location and Surveys
- Location Section
- Survey Section
- Geodetic Survey Section
- Photogrammetric Section

Environmental Section

Special Project Section

The joint effort of the six sections provides the tools to complete the project development phase of transportation projects, and to provide details for final design and construction.

LOCATION SECTION

This section prepares location studies and follows up with the organizing, preparing and conducting of Public Hearings, Public Meetings and Workshop Sessions throughout the Commonwealth.

There are several location studies being conducted by this section in addition to Consultant studies. Consultant contracts are under the supervision of this section. These contracts pertain to various study phases of proposed construction or reconstruction of State or Inter-State highways.

Unique concepts are being explored for multi-model transportation such as: Alewife Brook Parkway examines concepts for combining highways, transit, and commuter rail, while allowing for extensive park improvements including bicycle and pedestrian paths in cooperation with M.D.C. South Quincy-Braintree study looks at direct access from the major highway network to the Transit Station to determine their integration capabilities.

Following is a list of projects assigned to this section.

1. Route 56 Leister, Location Study and reviewed Corridor Planning Study.
2. Route 140, Sterling, Limited Location Study
3. Limited Location Study of an East-West Connector Highway from Sturbridge to Webster-Oxford Town Line (H6065I)
4. Limited Location Study, Route 126, Concord-Lincoln

LOCATION SECTION

5. Route 85 Connector, Location Study, Marlboro-Hudson.
6. Access Road studies for Resource Recovery Site Locations.
7. Route 140, Westminster and reviewed Corridor Planning Study.
8. Route 27 and other access roads, Maynard Digital Equipment Corporation.
9. Route 7, Pittsfield By-Pass, reviewed consultants Alternatives, first phase.
10. Route 140, Princetown-Westminster, Location Study.
11. Pondunk Pike, Spencer, Road Layout for Attorney General's Office.
12. Study slip ramp at Route 2 and 140 in Westminster.
13. Route 140 and West Main Street interchange, Gardner-Westminster.
14. Beverly Comminity College, Access Road.
15. Route 6A, Orleans, Location Study.
16. Cambridge, Water Supply Outline Study.
17. I-95 and Corey Street Diamond Interchange Study, Walpole-Sharon.
18. I-291 & I-90 (Toll Road) Interchange, Chicopee
19. Route 2, Acton, Concord, Lincoln and Lexington
20. Lawrence, Canal Street
21. Route 44, Carver, Kingston, Plympton
22. Orleans Route 6-A

Consultants Contracts

Route 10, Southwick, Westfield, Southampton

Route 146, Millville-Uxbridge 93/16

Routes 93/16 Medford

Route 57, Southwick-Agawam

SURVEYS SECTION

The Surveys Section was responsible for the assignment of seventy nine private survey parties to the eight districts. These survey parties augment forty four State survey parties. The parties are responsible for survey details for preliminary engineering plans, the layout of geometric survey for base lines, center lines, side lines, cross-section, etc. for final design plans and the control of the geometrics during the construction phases of the project.

GEODETIC SURVEY SECTION

The Geodetic Survey Section during this fiscal year used the services of two contract survey parties. The work accomplished was 200 miles of 1st and 2nd order traverse; 50 miles of 2nd order levels; establishment of 140 satellite stations in the Metropolitan Boston Area; 610 monuments; 1900 stations recovered; 83 stations reported destroyed and 23 Bench Marks transferred. Major areas worked in include the Central Artery, Southeast Expressway, Metropolitan Boston, North Shore, Essex County, Route 91 from Connecticut to Vermont and the Park Plaza Project.

The responsibility of the Geodetic Survey Section, with the manpower, instrumentation, transportation and funding available, is to provide the horizontal and vertical survey control network necessary to meet the needs in both the public and private sections.

The bulk of the work was done under the WPA in the seven years prior to World Was II. The establishment of this net was a fortunate by-product of the primary decision to employ men. Relatively few knew or cared that this would be a valuable resource. Since World War II most of the densification of the net consisted

of running traverse lines for highway construction or improvement. The proximity to highways has resulted in much attrition of and patching of original net. Moreover, these traverse lines tended to be long strings with little cross bracing which introduced a weakness or sway in the adjustment. The Department now has the capability to adjust surveys which are inherently more rigid.

Some traverses were not executed with the precision to yield the resolution requirements of today. The practice of starting and ending a new traverse on points in the same traverse line concantenation yields a relative or internal accuracy much exaggerated from the absolute accuracy between points not in the same line. Town corners, for the most part, were never adjusted into the 1927 North American Datum. Many monuments have only a horizontal or vertical position, not both. Many monuments have good position but are inaccessible or unusable in a practical sense. Former rural areas have been urbanized, requiring densification. The criteria for spacing of survey monuments is 4,000 meters (2½ miles) in rural areas; 800 meters (½ mile) suburban and 300 meters (1,000 feet) urban.

The urban area of Massachusetts has changed from 1,103 square miles to 2,558 square miles. These figures, with the spacing requirements above, yield 34,000 and 73,000 monuments respectively.

A more reliable estimate of monumentation required is one monument per one hundred parcels. This figure not only gives the total required but can be applied town by town to assure monuments are set where needed. A general estimate of 1 parcel per 3 persons per population yield a figure of 19,000 monuments.

Although we have approximately 17,000 monuments in place, it would appear that we need only 2,000 more; but 9,000 is probably closer to the truth.

Photogrammetric Section

The responsibility of the Photogrammetric Section covers aerial photography, aerial photogrammetric surveys, and the U. S. Geological Survey - Mass. Department of Public Works Cooperative topographic quadrangle mapping program.

The responsibility for aerial photography and aerial photogrammetric surveys includes the soliciting of proposals for aerial photographic and aerial photogrammetric projects, preparation of aerial consultant contracts for Departmental processing and approval, overseeing the performance of such contracts, recommending payments on billings for such contracts, recommending approval of contract completion reports, and any other matter that may be required on such contracts.

The responsibility for the annual 50 -50 cooperative with the U. S. Geological Survey (Eastern Mapping Center) covers initiating the renewal of the agreement, which is for the maintenance and the continuing up-dating of the 1:25000 topographic quadrangle maps of the Commonwealth, and preparing the agreement for Departmental processing and approval.

Generalized photographic interpretation using vertical stereo aerial photography, is provided by the Photogrammetric Engineer whenever it is necessary, and assistance is furnished to those doing their own photographic interpretation.

The Photogrammetric Engineer has had frequent requests for information concerning various aspects of aerial photogrammetry, both by telephone and by in-office interview. Some of these have

been requests for general photogrammetric information, but a substantial number were specific questions concerning large scale mapping, from representatives of various state and local government agencies.

There is a continued interest in our aerial photographic coverage, specifically our statewide 1" = 600' photography. We also get numerous requests for copies of our 1" = 200' and 1" = 100' topographic plans from government agencies, including this Department, even though a lot of our mapping is old and most of it was done before the new highways were built.

Five photogrammetric survey projects were initiated and forwarded through the regular channels for approval, of which two were started in this fiscal year. Two other projects were flown during the spring flying season, but have not yet gone beyond requests for proposals.

Three aerial photogrammetric survey contracts were completed during the year:

1. Chicago Aerial Survey - Contract #19260
   Boston Central Artery, Boston at $289,381.27
   1"=40', 1"=100', 1"=200', covering 2.12 square miles

2. Moore Survey & Mapping Corp. - Contract #19814
   Route 3 at Long Pond Road, Plymouth at $10,569.00
   1"=40' with 1" contours & cross-sections covering
   0.13 square miles

3. Col-East, Inc. - Contract #19853
   Connector Road from Route 125 connector to Route I-495
   and Route 125
   Haverhill-North Andover at $9,059.00
   1"=200' with 5' contours covering 4.21 square miles

Practically all of our 1"=100' and 1"=200' aerial photogrammetric topographic survey plan sheets do not have our current limited access highway systems shown on them. A demonstrated need has been shown for obtaining new photogrammetric surveys

to cover these limited access highways. Such new photogrammetric surveys should be made at a scale of 1:1200 (1"=100') with 2 foot contours or at a scale of 1:1250 (1cm-12.5 meters) with 0.5 meter contours, with the plan sheets showing the position of every baseline PC, PT, and 500 foot station. These plans would cover highway locations in a ½ mile wide strip and could be used for a variety of purposes, such as drainage problems, safety reconstruction projects, accident studies, and traffic signing studies.

Our Statewide aerial photographic coverage, at a scale of 1:7200 (1"=600'), dates from 1960 to 1974 and should be brought up to date. The new photographic coverage could be at ascale of 1:1200 (1"=1000') taken with a 6" mapping lens camera, so that it would be possible to use the photography for mapping purposes at a scale of 1:2400 or 1:2500 whenever necessary. See attached map showing this coverage.

We do not have any large scale mapping coverage of the complete area of the Commonwealth. A program, possibly in conjunction with other Commonwealth agencies, should be considered to obtain a precise photogrammetric survey of the Commonwealth at a scale of 1:2500 with 1 meter contour intervals. In the Berkshire region, the contour intervals could be a 2 meters.

ENVIRONMENTAL SECTION

During the past year, three (3) Final and three (3) Draft Environmental Statements have been completed for major projects in response to the National Environmental Policy Act. For the Massachusetts Environmental Protection Act there have been sisty-six (66) Environmental Assessments and nine (9) Environmental Impact Reports processed. In addition, seventy-six (76) Assessments prepared by other state agencies have been received and evaluated, with appropriate comments forwarded when required.

The conservation preservation and documentation of historic and cultural resources continues to be a major concern in the evaluation of environmental impacts. Four (4) major studies were made during the past year through contracts with academic institutions. Major contributions have been made in the preservation of our cultural resources and considerable knowledge has been gained of the occupation of the northeast, prior to the colonial period. The Department continues to retain the services of a staff archaeologist and has worked cooperatively with the Massachusetts Historic Commission to conform to the requirements of the Advisory Council for Historic Preservation.

The interdisciplinary staff, in addition to an archaeologist, is composed of a chemical engineer and an architect with the remainder of the staff educated and trained in engineering. In addition to primary duties as project managers, all staff personnel specialize in specific area, i.e. noise, air, water, cultural resources, etc. Other state agencies also provide support services in their areas of expertise, such as natural resources, fish and wildlife, commerce and development.

In order to be current with the state-of-the-art, staff personnel attended training courses and seminars. Most of the courses are sponsered by the Federal Highway Administration as a continuation of their cooperative ventures with the state highway agencies.

Interagency meetings are continuing on a monthly basis. The meetings are attended by staff members of both Federal and State agencies. The meetings provide an informal forum for the discussion of items of mutual concern and the transfer of information. These meetings are extremely important in the development of the interdisciplinary process, providing for the integration of varied opinions and requirements.

During the past year, there have been major changes in legislation, rules, regulations and procedures. The Massachusetts Environmental Policy Act was the subject of a major legislative action which revised the guidelines and procedures. New computer programs were developed for noise and air analysis. Guidelines and procedures for the preservation of historic and cultural resources have been refined and defined in greater detail.

Considerable staff time and efforts were expanded our review and evaluation of the Coastal Zone Management Programs, the 208 Water Quality Program and Corridor Planning Study Reports. As a result of the findings in corridor studies, five (5) new projects were identified that will be the subject of more intense environmental and engineering effort in the next year.

The Final Environmental Impact Report for the Snow & Ice Control Program of the D.P.W., MBTA, MTA and MDC was completed and forwarded to the Executive Office of Environmental Affairs for processing, evaluation and comment. Input for the study was provided by the agencies involved, other state agencies, private industry, interested associations and regional planning agencies.

As a result of the study for the Snow & Ice Control Program, it was determined that the storage of chemicals is an important consideration. The Department has continued to enclose stored chemicals in appropriate structures. Additionally, the Department has provided thirty-four (34) municipalities with chemical storage sheds. The location of the sheds was determined through an analysis of the need to protect public water supplies, water supply areas and other environmental considerations.

In the six (6) years since the section was established, most major projects have had the environmental consequences determined, evaluated, processed and approved. The major projects are Routes I-95, I-190, I-495, Central Artery-North, Routes 25, 28, 57, and 146. The emphasis in the future years will be on the bridge replacement program and the up-grading of major arterials to the existing primary highway system.

SPECIAL PROJECTS

The function of the Special Projects Section is primarily to establish the feasibility of program recommendations developed in the Long Range Planning Process. This feasibility is investigated by means of a Project Development Composite Report which narrows the choice of alternative solutions proposed, recommends No-Build decisions or recycles the project to Planning for further local and regional consideration.

A Project Development Composite Report includes all or one of the following activities:

(1) Project Background and History

(2) Engineering Study and Report

(3) Environmental Impacts or Statement

(4) 4(f) Statement where required

(5) Preliminary Relocation Report

(6) Documentation of Sources and Public Hearing Transcript

(7) Plans

Other Special Project tasks include assumption of projects from other Departmental Divisions for completion of urgent preliminary requirements in Design or Construction programs. These include such categories as closing complex programs as the Boston Transportation Planning Review Contracts, Boarding, Fencing and Demolition Contracts in Major Corridors programmed for Construction.

The Special Projects Staff consists of four (4) engineers, and in the past year was involved in the administration or active management of the following projects:

SPECIAL PROJECTS

1. Northern Avenue Bridge - Basic Design EIS - delayed several years for multiple revisions generated by the participating process - review process continuing.
2. Bridge Replacement across the Wareham River in Wareham Composite Project Development Report under way.
3. Marshfield-Scituate Bridge Replacement across North River. Project Development Composite Report under way.
4. Holyoke-South Hadley Bridge Replacement across the Connecticut River. Project Development Composite Report initiatet.
5. Framingham-Danforth Street Bridge Replacement - Negative Declaration/4(f) Final Statement. Completed in-house August 1978.
6. Route 1 Revere-Saugus - Final Engineering Study Report of Roadway Improvements between Cutler Circle, Revere and the Saugus-Lynnfield Town line including 4 interchange modifications.
7. Revere Beach Connector - EIS for new roadway between Cutler Circle to Revere Street-Ocean Avenue to provide service from Route 1 to the Revere Waterfront.
8. Salem-Peabody Connector - Final EIS on new corridor between Beverly and Route 128 Peabody. Known as Task "B".
9. Task A coordinated with "B" (above) to complete improved connection from Route 128 to I-95 Lynnfield including the relocation of a section of Route 128 in the vicinity of Forest Street Peabody.

SPECIAL PROJECTS

10. Chelsea Transportation Study. An Engineering Report to provide improved transportation alternatives for Redevelopment programs for Murray Industrial Park and the Naval Hospital areas of Chelsea. Terminated October 1973 by agreement with the City of Chelsea upon completion of a basic design of several alternative improvements.
11. Coordinated Parking studies and designs for MBTA Wonderland in Revere, Forest Hills, Woburn and Route 128 - I-95 (Dedham - Westwood).
12. Coordinated study with MDC - Revere Beach Connector for Revere Beach Reservation improvements.
13. Completion of Boston Transportation Planning Review contracts for payment of accepted costs.
14. Engineering coordination with Office of State Planning for proposed commercial developments of Wellington Station, Medford, First National Stores property, Somerville and Murray Industrial Park, Chelsea.
15. Southwest Corridor coordination with MBTA and DOTC for all historical plan and ROW data.

HIGHWAY ENGINEERING DIVISION

Highway Design
Consultant Contract Engineer
Plans Section
Roadside Development
Urban Systems Section
Urban Design
Specifications
Plans & Records
Layouts
Hydraulics
Utilities
Bridge Section
State Aid

Highway Engineering Division

Highway Design

Highway Engineering is responsible for the engineering and administration required to produce construction plans, which are used to advertise for bids and to then construct the projects.

Highway Design therefore, has a similar responsibility on the next level. Although design done here excludes structural work, all the other diverse disciplines needed to engineer and process the Plans, Specifications and Estimates are coordinated here.

Projects prepared or generated within the Engineering Division are processed through the Design Section as well.

Work during the last year has ranged from Interstate safety through intermediate construction and reconstruction and includes safety projects, sub-standard bridges and bicycle path design.

Liaison with Consultant Design Engineers is maintained by Expediters, supervising all phases of such work.

Within the Highway Design Section, projects were designed and processed for advertising in the following categories, and indicated values:

	Miles	Value
Construction	11.1	$53,840,000
Reconstruction	2.7	22,100,000
Safety (Includes Interstate)	50.6	19,381,500
Sub-Standard Bridges	15(Structures)	9,085,500

Brief summaries of the individual sub-sections of Highway Design follow.

CONSULTANT CONTRACT ENGINEER

The responsiblity of the Consultant Contract Engineer's Office is to review all proposed "03" consultant contracts and agreements, as well as extra work orders, adjustments in fees and extensions of time on active contracts.

All new contracts and revisions to existing contracts are submitted to this Office by the Department's Bureau of Traffic Operations, Right of Way, Project Development and Transportation, Planning & Development and also by the various Sections such as Bridge, Highway Design, Maintenance, Central Artery and Research & Materials.

The Contract Engineer takes particular note of the scope of work, special provisions, standard provisions, compensation, method of payment, time schedule and required attachments to ensure that the contract or agreement conforms to Department Standards. Also, he reviews all items in the package which he forwards to the Public Works Commission via the Director of the Capital Expenditures and Programming Office (CEPO) to ensure that the documents comply with the rules and regulations of the Executive Office of Administration & Finance.

Following is a summary of the dollar values for the workload processed in Fiscal 1978

New Contracts & Agreements	$10,210,000.00
Extra Work & Fee Adjustments	2,580,000.00
Extensions of Time	31

PLANS SECTION

This Section prepares base plans, profiles, cross-sections, Right-Of-Way Plans etc. incorporating all Survey information, on which is depicted the existing physical conditions of the site. These plans are used as the base on which the design is formulated and placed. The Right-Of-Way plans are used for property takings and for State Highway Layouts.

During the past year plans were prepared for projects totalling:

New Construction	3 Miles
Reconstruction	6 Miles
Safety	5 Miles
Right-Of-Way	3 Miles

Twelve municipalities were involved.

ROADSIDE DEVELOPMENT SECTION

The functions of this Section include the aspects of the Highway Beautification Act of 1965 dealing with design of highway and other transportation facilities' landscaping, junkyard screening and roadside tourist/traveler facilities. The Roadside Section, working as a small (4-5 persons) specialized operation, is involved in phases ranging from planning and program development, project design, assistance and review of consultant's project design and assistance to construction personnel on landscaping matters.

CONTRACTED WORK

Landscaping and Junkyard contracts advertised through this Section in F.Y. 1978 totaled $2,120,000 ($33,000 for a Junkyard). Undefined amounts of landscape work were also included with many highway construction contracts.

PLANNING AND PROGRAM DEVELOPMENT

1. Worked to establish a Research Project on Roadside Wildflowers with the University of Massachusetts.

2. Developed and implemented a program for using slow-release fertilizing packets with landscape plant materials. These packets extend fertilization for as long as 6 years from this initial investment.

3. Planned for design and construction of a prototype four unit rest room building for the rest area on Route 128 in Westwood. This facility is planned to be used in the future to replace the portable chemical toilets at other rest areas.

Roadside Development Section, cont.

4. Plans are being considered to improve certain rest areas on I-95, I-195 and I-495. Permanent rest room facilities are desperately needed in certain areas.

PROJECT DEVELOPMENT

Promoted in-house liaison with Regional Tourist Councils for development of rest area/information center projects on I-91 in West Springfield and the Bernardston-Greenfield area, I-95 in Salisbury and Route 3 in Plymouth.

MANAGED CONSULTANT CONTRACTORS

1. In design of five (5) landscape projects.

2. For Liaison between the Department and the Executive Office of Environmental Affairs on aspects of the highway "Environment and Aesthetics".

3. In design of a new rest area for an Information Center on Route 3 in the Town of Plymouth.

LEGISLATION

Reviewed and commented on legislation related to the Section's activity.

DESIGN REVIEW

Reviewed numerous in-house and consultant projects managed by other Sections for recommendations, including landscaping, erosion control plantings and rest area design.

Roadside Development Section, cont.

CONSTRUCTION REVIEW

This Section's personnel were called upon for recommendations as to: Extra Work Orders; Material substitutions; Acceptability of supplied plant materials; Acceptability of certain completed work; and various landscaping changes required due to unforseen field conditions.

URBAN SYSTEMS SECTION

The Urban Systems Section is responsible for the review and processing of Safety Improvement Projects on existing public streets.

During 1978, twenty-five projects, with an estimated construction cost of 12.0 million dollars, were prepared for advertising. Ten of the projects were designed by consultant firms hired by the Department; eight projects were designed by consultant firms hired by local communities or the M.D.C., two of which used State Aid Funds; five projects were design by District Offices; one by the local community and one by the Traffic Signal Section.

These twenty-five Safety Projects included the following:

Construction of a new pedestrian overpass; construction of a parking garage; major reconstruction of an arterial street; extensive landscaping and park improvements; construction of bus turn-outs; railroad crossing improvements and pre-emption; reconstruction of a bridge deck; water system betterments; and new or up-graded traffic signals at seventy-five intersections.

Urban Design Section

The Urban Design Section reviews, evaluates and expedites Urban System, State and Interstate Highway Projects, prepared by State, City and Consultant Engineers, predominantly in Urban Areas;

Reviews and evaluates Basic Design Reports prepared by others;

Reviews and evaluates Engineering Service Fee proposals submitted by prospective consultants and participates in related negotiations;

Prepares construction and maintenance cost reports on various proposed highway networks.

During fiscal 1978 this Section was involved in negotiations with prospective consultants for nine design contracts; reviewing and expediting final designs for eight projects; reviewing basic designs for two projects and preparing estimate report for completing the Interstate System.

SPECIFICATIONS SECTION

The Specifications Section of the Department is responsible for the preparation and distribution of Proposals and Addenda necessary for all advertised Construction, Reconstruction and Maintenance Projects. During Fiscal 1978, approximately 265 proposals were prepared and advertised for bids. This amounted to approximately $166,242,000.00.

PLANS & RECORDS SECTION

The function of this Section is to store, catalogue and issue for reproduction all layouts, construction tracings, cross-sections, roll plans and profiles; also books of record from Construction. Survey books are stored here for a record of their location.

Prints are procured of construction tracings, roll plans and profiles for the Department, other Commonwealth Agencies, Consultants, and the general public.

Procurement and assignment of all bound books for Design and Construction phases of projects and survey books.

All final records for projects are received, recorded and forwarded to the Final Estimating Section for processing. Upon completion, they are returned for storage and reference.

Layouts Section

The Layouts Section of the Highway Engineering Division of the Massachusetts Department of Public Works has the responsibility for the preparation of the required plans and written Orders of Taking to be filed in the various Registry of Deeds in order to secure the necessary legal rights in the parcels of land affected by the planned construction and/or reconstruction of State highways.

From July 1, 1977 to June 30, 1978

One hundred and eighty-three instruments were prepared involving the addition of 11.0 miles of State Highways, alterations to several existing State Highways, and the advance acquisition of required rights at locations of existing and proposed State Highways.

Hydraulic Section

On November 11, 1974 the Hydraulic Section was established within the Department of Public Works and set up as a Unit answerable directly to the Highway and Structures Engineer. Three engineers from the Department are assigned to the Section in the Boston Office.

The Section was formed for the purpose of 'centralizing' the Department's activities in two major areas; namely the hydraulic design of bridges and culverts, and the design and improvement of highway drainage systems. The work done by the Section is specialized and requires a thorough understanding and knowledge of the practices and principles of hydrology and hydraulics.

Description of Work:

In addition to the Unit's assignments involving in-house hydraulic design and consultant-review work, the Section serves another very important role by providing hydraulic review and advisory services to other Sections and the District Highway Offices on various kinds of drainage problems. During this past year the Hydraulic Section has provided technical advice and assistance to the following units: the Bridge and Maintenance Sections, the Right of Way Bureau on matters involving drainage takings and flowage easements, the Construction Division, and the Highway Engineering Division on various matters requiring hydraulic investigation.

The following is a more detailed description of the major duties and assignments performed by the Unit this past year. Such work includes: 1) the determination and/or review of Hydraulic Data on Bridge sketch plans, 2) in-house drainage studies and review of consultant-contract drainage studies, 3) the investigation, analysis, and solution

of special drainage problems and embankment scour of highways bordering on rivers and streams, 4) technical report writing, 5) review of consultant man-hour proposals on projects requiring hydrologic and hydraulic analysis, 6) design of protective channel lining and stone revetment for roadway bank stabilization, 7) basic-design review meetings and discussions with consultant engineers on hydraulic design criteria, 8) coordination of periodic training conferences and hydraulic demonstration projects for Department engineers, 9) technical representation on Department-sponsored hydrologic research projects, 10) communication with other State and Federal agencies, such as the Corps of Engineers, the Federal Highway Administration, the Soil Conservation Service, the Geological Survey, etc. for information and discussion of flood profiles, peak discharge data and flood-flow frequency, flood plain information studies, flood hazard analysis reports and other important flood data that is useful in the Section's hydraulic design and analysis work.

- UTILITIES SECTION -

The activities of the Utilities Section pertain to liaison work between the Department of Public Works and Private and Public Utility Companies, Railroads, Municipalities, other State Authorities and Departments, and the United States Department of Transportation - Federal Highway Administration (F.H.W.A.).

These activities relate to alterations, relocations, and betterments of the facilities of these Companies, Authorities and Municipalities made necessary by Highway and Bridge Construction performed under the specifications and supervision of this Department.

During fiscal 1978 the Utilities Section processed one hundred twenty-four (124) agreements with an estimated cost of approximately Nine and One-Half Million Dollars as follows:

Grade Crossing Improvement Program (13 Agreements)

33	Crossings with B & M Railroad	$2,952,377
24	Crossings with CONRAIL	1,113,355
1	Crossings with Central Vermont Railroad	21,451
58	Crossings Total	$4,087,183

Construction Related Agreements:

87	Construction Including Bridges, Interstates, Topics Relocation of Facilities, etc.	$4,771,824
24	Betterment and Policy Agreements	497,730
111	Total	$5,269,554

GRAND TOTAL $9,356,737

BRIDGE SECTION

The Department of Public Works is the owner of approximately 2565 bridges in the Commonwealth of Massachusetts. They vary in size, type, age and condition, from a stone arch built more than 200 years ago in Ipswich to a mile long structure spanning the Taunton River.

In addition to the DPW owned bridges, there are 2800 bridges under the ownership of cities and towns.

During the annual report period extending from July 1, 1977 to June 30, 1978, the Department advertised for bids for construction or reconstruction of 31 bridges, 9 culverts, 1 pedestrian overpass and 5 walls, and for the improvement of 25 structures, at a total structural cost of $50,540,832.

These structures are located in 34 cities and towns thoughout the Commonwealth, and their total structural cost was distributed to the following categories:

Federal Aid	$50,097,586
Non Federal Aid	
State Highway	
Substandard Bridges	443,246
Maintenance	
State Aid	
	$50,540,832

The major projects which were advertised for construction and bids received during the current year were the following:

Area	City/Town	Cost
Rte I	Dedham 1, Bridge	$ 364,120
Rte 3	Kingston & Plymouth *8Bridge Improvements	1,454,831
Rte 9	Natick 3 Walls	577,330
Rte 28	Medford-Somerville 1 Bridge	2, 621,890
Rte 31	Ashby 3 Culverts	270,627
Rte 62	Concord 1 Bridge, 1 Culvert	342,484
Rte 138	Raynham 1 Bridge	1, 037,830
Rte 140	Mansfield 1 Bridge	1, 556,190
I-91	Bernardston & Deerfield 5 Culverts & 2 Br. Improvements	1,419,635
I-93	Medford to Methuen 12 Bridge Improvements	292,030
I-95	Amesbury & Newburyport 1 Bridge Improvement	2,174,925
I-190	Lancaster & Leominster 2 Bridges	2,083,440
I-291	Chicopee - 1 Bridge Improvement	240,012
I-391	Chicopee & Holyoke 1 Bridge	10,509,000
I-495	Mansfield & Raynham 4 Bridges	2,957,547

The cities and towns in which the remainder of the structures for which bids were received are:

City/Town	Cost	Structure(s)
Boston	$ 251,979	1 Bridge
Braintree	3, 215,050	2 Bridges
Bridgewater	265,025	1 Bridge
Brockton	342,425	1 Bridge
Dover	252,877	1 Bridge
Hardwick-New Braintree	343,579	1 Bridge
Hinsdale	154,226	1 Bridge
Leominster	13,202	1 Bridge Improvement
Mansfield	1, 021,515	1 Bridge
Middleborough	258,540	1 Bridge
Middleton	289,020	1 Bridge
Natick	1, 800,574	4 Bridges & 2 Walls
Needham	195,692	1 Bridge
Raynham	1, 247,551	2 Bridges
Salem	185,720	1 Pedestrian Overpass
Stockbridge	404,716	1 Bridge

The Bridge Section has been involved with the checking of the designs and the checking of shop drawings for various traffic sign contracts.

Within the Bridge Section we have the Metals Control Unit which is a multifaceted engineering service group. Its primary purpose is to provide a system for inspection and quality control that will guarantee the structural integrity of bridges that are to be incorporated into the State Highway System.

One of the tasks of the Bridge Section is the rating of bridges to determine the safe allowable load. During this annual report period, 95 bridges have been rated.

The Department continues to receive requests from utility companies to place utilities on existing bridges. Also requests for permits to move overweight loads over bridges. In each case the bridge involved is analyzed structurally to insure that the safety of the public is not jeopardized.

The Bridge Section also investigates damage and develops repair procedures for bridges damaged by trucks impacting superstructures or by fire.

Checking the stresses on structures which result from adding deck overlays to bridge decks is also a function of the Bridge Section.

It is also an important function of the Bridge Section to resolve problems arising during construction.

Another function of the Bridge Section is the review of plans for the extension of the Mass. Bay Transportation Authority (MBTA).

State Aid activities of note for Fiscal Year 1978, will be summarized under the headings of Funding, the State Aid Primary System and Bikeway Projects.

Funding

The annual State Aid Highway Appropriation to the 351 Cities and Towns for Fiscal Year 1978, was $13,538,720.00; the Allocations being the same as for the 3 prior Fiscal Years that were funded under Chapter 765, Acts of 1972.

These funds must be used for construction, reconstruction, or improvement projects under Chapter 90, Section 34, of the General Laws, and in accordance with Department Policies. Because these funds are from a Bond Issue (Chapter 356, Acts of 1977), the money may not be used for Maintenance.

In addition to these funds, disbursements of $25,043,000.00 were made to Municipalities under Chapter 497, Acts of 1971, as amended by Chapter 492, Acts of 1974. These Acts provide that one cent of the State Tax on Motor Fuels be returned to the Cities and Towns as a Cherry Sheet Item. This distribution is to reduce property taxes for the costs of construction, maintenance, and policing of the public ways.

Also, distributed to the Cities and Towns under Chapter 363A, Acts of 1977 (the Budget), was $20,969,803.00 for highway and mass transportation purposes. The distribution of $2,500,000.00 to the 50 Communities on the "fringe" of the Massachusetts Bay Transit Authority core area was by check, while the distribution of $18,469,803.00 to the 272 Municipalities outside both areas was by Cherry Sheet.

The Department advertised 21 State Aid projects with an estimated Project Value of $5.24 million this past Fiscal Year. In the same period, approximately $12.35 million was encumbered for Force Account or Advertised Work.

The State Aid Primary System

During this Fiscal Year the Department has integrated "Chapter 90 Work" into the Functional Classification of Highways concept by means of the State Aid ('Chapter 90') Primary System. This System

is a network (not necessarily interconnected) of public ways under local jurisdiction that have local or regional significance by their functional classification as Arterials or Collectors. Projects on the State Aid Primary System which meet Department Standards for Safety and Design have no Municipality matching fund requirements. If work is off the System, the Municipality must contribute 25% of the cost.

Bikeway Projects

The State Aid Section is now coordinating the design and construction of Non-Federal-Aid Bikeway Projects that have been approved for implementation by the Project Review Committee. These projects originate with the Community, are endorsed by the Regional Planning Agency, and approved for feasibility by the District before the Bureau of Transportation Planning and Development submits them to the Project Review Committee. On June 30, 1978, funds were encumbered for 7 Projects totalling $340,192.00, with an additional project for $32,629.00 awaiting approval of the Agreement by the Public Works Commission.

RIGHT OF WAY BUREAU

RIGHT OF WAY BUREAU

RELOCATION PLANNING

The Relocation Planning Section regularly works with Department Environmental Engineers, Project Expeditors, Location and Design Personnel, as well as consultants to the Department in developing highway alignment and design alternatives to advise on certain social and economics effect of the proposed facilities, including impacts on families and businesses to be displaced, employment and tax loss, effects of business displacement, possible disruption to neighborhoods and local trade, and the relocation of established families and businesses. Over 40 projects were actively worked on during Fiscal Year 1978. In addition Conceptual Stage Relocation Plans were prepared for 10 projects which could have involved the displacement of as many as 200 families and 100 businesses in the various alternatives. Right of Way Stage Relocation Plans were prepared for 7 projects and 12 Right of Way Stage Relocation Plans were developed for submission with requests for hardship acquisitions. Six Right of Way Stage Relocation Plans were developed for Last Resort Housing.

PROJECTS

During Fiscal Year 1978, the Right of Way Bureau Project Section worked on 564 cases, involving about 93 cities and towns. The work that is carried out by the Project Section includes the establishment of property ownership, securing real estate tax assessments, conducting property interviews with owners and tenants, preparing layout, demolition, sign, structure and occupancy reports, and investigating complaints such as well contamination and drainage problems because of road construction activities.

Land and easement takings were made in connection with new highways as well as modernization of existing highways including maintenance sites, rest areas, drainage betterments, construction, drainage and other types of easements.

A total of 564 interviews were conducted with property owners. Preliminary data and plans were compiled for 424 cases which were sent to staff appraisers and 144 cases which were sent to fee appraisers for appraisal.

The Right of Way Project Section also monitored Right of Way acquisition by cities and towns in connection with Federally-aided Urban Systems Projects, in order to be able to certify to the Federal Highway Administration that acquisition, appraisal and relocation procedures were carried out in compliance with Title II and/or Title III, Uniform Relocation Assistance and Real Property acquisition Policies Act of 1970.

CONVEYANCING

The Conveyancing Section in compliance with requests from Projects assigned 752 full title examinations and 254 rundown examinations to fee conveyancers and 109 title examinations and 43 rundown examinations to staff conveyancers. In addition 254 rundown examinations were conducted by staff conveyancers upon the recording of layouts and orders of taking for this period. Takings for 177 projects were filed for recording in the various Registries of Deeds including required formal service of notice on City and Town Officials and the respective County Commissioners. Individual land damage case files were prepared including the preparation of all required legal documents needed to effect payment of the awards. In those cases that presented legal impediments to payment, owners or their attorneys were seasonably notified and advised as to the legal steps to be taken to clear the title. A total of 1142 titles were reviewed by staff and notations made in the case files as to the

nature of any encumbrance of impediment to payment that would have to be cleared.

During this period 435 acquisition payments were processed including the invoicing to the Comptroller for the issuance of payment checks. In addition, 66 backlog payments including the retrieval of 48 checks that were on deposit in the Eminent Domain Trust Fund under the provisions of Chapter 795 of the Acts of 1970 were processed and paid to the owners. 109 checks were deposited in the Eminent Domain Trust Fund. A total of 297 cases were paid of which 239 were paid pro tanto and 58 by release. Deeds for 120 railroad bridges under the provisions of Chapter 634 of the Acts of 1971 were approved and recorded. 18 Orders of Conditions and 3 Certificates of Completion were filed. 28 payments were made in connection with the Highway Beautification Program.

During this period 130 court judgments were handled and processed in the total amount of $2,950,773 over and above the pro tanto payments and settled in the following manner:

8 jury verdicts totalling	$ 301,450.
14 findings of the court	$ 518,223.
14 orders for judgment totalling	$ 713,854.
93 agreements for judgment totalling	$1,417,244.

The handling of such Court Judgments involves keeping record of Petitions filed, constant telephone calls and conferences with the Attorney General prior to settlement regarding law, procedure, and Pro Tanto information; coordinating the Judgment with the Title Abstract as to proper parties plaintiff and clearing of encumbrances; verifying all facets of the Judgment as to compliance with Federal regulations, correctness of calculations, credits for

Pro Tanto payment, replacement housing, and rent owed; conferences with various Clerks of the Superior Courts relative thereto; checking on funds, invoicing and final delivery of checks to the Office of the Attorney General.

This section is also charged with the sale of land acquired in the Southwest Corridor for the construction of I-95 which has been approved for sale by the Commonwealth by the Southwest Corridor Coordinator. The procedure employed is to notify former owners that the property is available for "buy back" enclosing an offer to purchase. In cases where the former owner does not purchase, it is offered to qualified tenants and then advertised for sealed bids and sold to the highest bidder. A Deed is then prepared which is submitted to the Board of Commissioners and the Attorney General for approval. Arrangements are then made for a closing date at which time transaction is completed.

This section also prepares deeds to Cities, Towns and other public agencies of land for public use no longer needed for highway purposes, as well as granting easements to public utilities for relocation of their facilities.

During this period:

15 parcels were deeded to City of Boston
10 parcels were deeded to City of Lynn
13 parcels were deeded to various other Cities and Towns
3 easements granted to Public Utilities

Leases for commuter parking were drafted in the Towns of Hingham, Kingston, Quincy, Braintree and West Bridgewater and various other leases were prepared for excess land not presently required for highway purposes.

APPRAISALS

During the 1977 Fiscal Year, 585 staff appraisals were prepared and completed. Included in this figure 23 appraisal reports were prepared for the

Property Management Section of the Bureau for various purposes, 11 appraisal reports prepared for the Relocation Section, 44 appraisal reports prepared for the Sign Removal Program instituted this Fiscal Year for acquisition.

Staff Appraisers were used in preparing for and appearing in the various Superior Courts of the Commonwealth on land damage cases. The Appraisal Section also prepared estimates for various Right of Way purposes.

APPRAISAL REVIEW

The primary duty of this section is to review all appraisal reports secured by the Right of Way Bureau and make a determination of fair market value or damages in connection with Department of Public Works property acquisition. In some land damage cases two appraisals are reviewed and on occasion three appraisals may be reviewed.

The reviewer is required to read and analyze the appraisal reports, corroborate data in the field, inspect the property and comparable sales and make a final determination of value or damages after familiarization of all aspects to value of the property being acquired.

Some of the secondary duties of the Review Appraiser are as follows:

1. Determination of items of personality
2. Certification of Personal Property Inventories made by the Relocation Advisory Section.
3. Determination of economic rents for use of the Relocation Advisory and Property Management Sections.
4. Reviewing values of State-owned excess land that is to be sold or leased.
5. Assisting the Attorney General's Office (Eminent Domain Division) in trial preparation of land damage cases and testifying as required.
6. Reviewing applicants for assignment as Fee Appraisers.
7. It is also the responsibility of the Review Section to

respond to all Federal-Aid Ineligibility Notifications from the Federal Highway Administration concerning appraisals and appraisal reviews.

In addition to the above the Supervisor of the Review Section is a member of the Fee Appraisal Assignment Committee which is reponsible for the assignment of Fee Appraisal Contracts and their fees, represents the Right of Way Bureau at the Governor's Council when requested in matters pertaining to the payment of Land Damages. He is also responsible for the activities of the Real Estate Review Board who meet and determine the final award of land damages on all cases in excess of $50,000.00. They also determine the value of land to be sold and leased by the Commonwealth and also determine the enhancement value of property when access is to be changed.

The records in this section show the following for Fiscal Year 1978:

No. of Staff Appraisals Reviewed	541
No. of Fee Appraisals Reviewed	296
No. of Cases Reviewed	743

Of the 743 cases reviewed 605 were on active highway projects, 15 advance acquisition and 123 miscellaneous. Under miscellaneous these cases involved property to be leased or sold by the Commonwealth (Excess Land), changes in access, review of cases from other State agencies such as the Department of Educations, Department of Environmental Management and the Attorney General's Office, appraisals of signs for the Control of Outdoor Advertising and appraisals of property to be leased by the Commonwealth for commuter parking.

The Review Section certified 74 Relocation Inventories, set economic rentals on 123 cases of which 68 were for single family units, 68 apartment units and 47 businesses.

The Real Estate Review Board met 48 times during the year and were

forwarded 70 cases which resulted in 65 recommendations of which 43 were for highway acquisition and 22 for miscellaneous items such as the sale and lease of excess land. The Reviewers were called upon personally to attend meetings with the Real Estate Review Board during this fiscal year.

ADVANCE ACQUISITION AND FUNCTIONAL REPLACEMENT

The Advance Acquisition Section processed 14 cases for acquisition in the past fiscal year for a total estimated damages in excess of $1,395,000. These cases included two functional replacements, a church in Chicopee and an airport in Mansfield. The acquisition of an archaelogical site; and two parcels of vacant land, three dwellings and two businesses by request of the owners because of hardship; two dwellings, one business, and one subdivision taken in the public interest.

This section has thirteen cases under consideration for early acquisition.

NEGOTIATIONS

During this period, from July 1, 1977 to June 30, 1978, the bulk of the Department's offers of fair market value by the Right of Way Bureau's Negotiations Section involved takings made in connection with I-495 construction in Mansfield, Norton, Raynham, and Taunton; I-190 construction in West Boylston, Sterling, Leominster and Lancaster; the Route 9 and Speen Street Interchange in Natick; Route 33 and 113 construction in South Hadley; I-391 construction in Chicopee; Route 31 construction in Ashby; the reconstruction of bridges in Andover, Dover, Brockton, Pittsfield, Chester, Middleboro, Worcester and Needham; other miscellaneous topics and safety projects throughout the State.

A breakdown of the Negotiations Section's activities is as follows:

A.	Offers of Fair Market Value	469
B.	Rent Supplement letters delivered and explained	63
C.	Replacement dwelling letter, delivered and explained	77
D.	Use and Occupancy Reports	179
E.	Pro Tanto receipts, releases and Land Damage Agreements obtained	111
F.	Right of Entries obtained	32
G.	Buy Back Reports	19
H.	Sell Back (Southwest Corridor Solicitations)	10
I.	Sign Control Offers to Purchase	77

During Fiscal Year 1978, the Negotiation Section was actively engaged in offering to purchase advertising signs, easements and leasehold interests in sign sites under the State's Highway Beautification Program. The Negotiation Section has settled 26 cases of the 43 cases assigned.

Offers to sell back properties taken in conjunction with the proposed Southwest Corridor (I-95) were solicited from 10 former owners or present tenants.

RELOCATION

During Fiscal Year 1978, replacement housing additives were computed for 65 residential owner-occupied families and Rent Supplement additives were computed for 54 residential occupants and takings affected 137 families and 39 businesses. In this period, 145 families were relocated and 52 businesses moved to new quarters.

There were 188 moving cost claims, both residential and business which were processed during the Fiscal Year involving a total amount of $927,243., 65 replacement housing allowance claims totalling $495,916. (average $7,629.), 54 rent supplement claims totalling $164,384 (average $3,433.), 141 dislocation

allowance claims totalling $27,500. (average $195), and 1 Last Resort claim totalling $15,333. A total of 461 business and residential relocation claims were processed in Fiscal Year 1978, and the total relocation cost was $1,691,710.

In addition, because of the requirements of the 1970 Uniform Relocation Act, relocation plans were required for all projects and these were prepared by Department personnel. The level of priority of relocation assistance has been given added emphasis and these requirements have resulted in a relocation section which consists of 19 Department relocation staff workers and the following contracts with the Boston Redevelopment Authority, Worcester Redevelopment Authority, Malden Redevelopment Authority and the Chicopee Redevelopment Authority to carry out the responsibilities of the Department in this area.

Boston Redevelopment Authority	-	$ 58,109.56
Malden Redevelopment Authority	-	$ 55,448.04
Worcester Redevelopment Authority	-	$ 64,701.14
Chicopee Redevelopment Authority	-	$115,870.67
TOTAL		$294,129.41

PROPERTY MANAGEMENT

During Fiscal Year 1978, 140 structures were acquired of which 100 were residential and 40 were commercial. During the same period 125 structures were released for demolition. Net proceeds received from rentals and sales of property was $582,658., which was received from the following sources:

Rental of property acquired for highway purposes	$107,554.
Sales of structures to be removed by purchasers	$116,042.
Sales of excess land	$117,530.
Sales of excess improved properties	$135,428.
Leases of Restaurant and Gas Station sites	$106,104.

ATTORNEY GENERAL LIAISON

The following represents the activities of the Attorney General Liaison Section for Fiscal Year 1978:

Number of cases requested by Department of Attorney General, Eminent Domain Division	87
Disposition report of petitioned land damage cases returned by Attorney General (closed)	147
Review of Interrogatories and answers thereto for Department Attorney General	11
Number of additional cases for Attorney General in which other documents, plans, witnesses secured for on-going land damage trials	135
Number of legislative bills written for 1978 Legislative session for DPW	24
Number of legislative bills for which written comments pro and con were prepared for 1978 session	45
Number of appearances before Legislative Committees for 1978 session	37
Acting as Hearing Officer at hearings (residential and business)	5
Representing Department as Counsel at Relocation hearings (residential and business)	12
Number of cases for Tort Division, Department of Attorney General requiring interviewing of witnesses, securing affidavits and other documentation	36

Otherwise the Attorney General Liaison Section was engaged in providing staff legal assistance to the Right of Way Bureau, the Department's Chief Counsel and in many areas for providing legal opinions and conferences within the Right of Way Bureau.

SIGN AND JUNKYARD CONTROL

During Fiscal Year 1978, this section completed the inventory of all legal and illegal signs located within 660 feet of the Interstate and Federal Aid Primary Highway System throughout the Commonwealth.

Over 3000 renewal applications for existing legal signs, and over 50 applications for new sign permits, which eminated from the Outdoor Advertising Division were reviewed for approval or rejection, testimony and review were offered at hearings conducted by the Outdoor Advertising Division, and 422 illegal signs were removed from the area under the Department's control.

21 legal compensable signs were acquired by the Department and 20 signs were removed and the owners compensated.

In addition the inventory was completed for all junkyards located along the Interstate and Federal-Aid Primary Highway System.

HIGHWAY CONSTRUCTION DIVISION

Construction Section

Contract Engineering

Final Review Section

The Construction Section of the Department of Public Works supervised the inspection of 93 construction projects, approximately 140 miles of additional highway construction and related work, during the 1977 Fiscal Year. This amounted in value of more than $106,934,000 of construction contract work awarded.

A summary of th e various categories of projects follows:

	MILES	AMOUNT
INTERSTATE	82.6	$60,242,184,04
PRIMARY, SECONDARY, URBAN	54.2	40,395,229.89
UMTA	0.2	4,857,886.00
NON FEDERAL AID	2.7	1,439,590.37
	139.7 Miles	$106,934,890.30

PROJECTS AWARDED DURING FISCAL 1978
INTERSTATE

I-86

HOLLAND-STURBRIDGE #19593	Roadside Development 3.0 Miles	$230,036.00

I-91

WHATELY-BERNARDSTON #19798	Resurfacing & Safety Improvement 16 Miles	5,852,022.70
LONGMEADOW-HOLYOKE #19708	Lighting 4.5 Miles	399,838.30
	20.5 Miles	$6,251,861.00

I-93

BOSTON-Southeast Expressway #19753	Bridge Screening	71,472.00
MEDFORD-WILMINGTON #19754	Bridge Screening	341,445.00
		$412,917.00

	I-95	
NEWBURYPORT-AMESBURY #19844	Safety Upgrading 1.3 Miles	$2,690,529.75
	I-190	
WORCESTER #19490	New Construction 0.7	12,388,428.89
LEOMINSTER, incl. Rt.2 #19687	New Construction 1.1 Miles	8,423,306.20
LANCASTER-LEOMINSTER #19797	New Construction 2.1 Miles	7,499,350.25
	3.9 Miles	$28,311,085.34
	I-291	
SPRINGFIELD-CHICOPEE #19796	Safety Upgrading 1.0 Miles	1,196,526.50
	I-391	
CHICOPEE-HOLYOKE #19819	New Bridge 0.2 Miles	7,506,917.00
CHICOPEE #19850	Demolition ---------	294,870.00
	0.2 Miles	$7,801,787.00
	I-495	
MANSFIELD-RAYNHAM #19494	Demolition	124,028.80
WESTFORD-CHELMSFORD #19591	Fencing	91,265.00
BOLTON-BOXBORO #19752	Roadside Development	175,012.50
HAVERHILL-SALISBURY #19773	Roadside Development 10.3 Miles	327,954.90
LAWRENCE-HAVERHILL #19782	Roadside Development 9.0 Miles	104,550.25
ANDOVER-NORTH ANDOVER #19794	Roadside Development 6.8 Miles	80,891.00
WESTBORO-BERLIN #19795	Roadside Development 8.4 Miles	144,726.50
LITTLETON-CHELMSFORD #19923	Roadside Development 10.2 Miles	339,471.50

MANSFIELD #20008	New Construction 1.7 Miles	11,629,600.00
WESTBORO-MILFORD #20149	Roadside Development 9.3 Miles	329,941.00
Total Interstate	55.7 Miles	$60,242,184.04

HIGH HAZARD (HHS)

WOBURN-Cambridge Street #19557	Sidewalk & Related Work 0.3 Miles	29,799.00
WAREHAM-Rte. 6-28 #19739	Safety Improvement 0.4 Miles	145,739.00
CAMBRIDGE-LYNN-BOSTON-REVERE #19749	Install.Impact Attenuation	121,910.00
NORTH ADAMS Rte. 2 #19761	Safety Improvement 0.6 Miles	265,703.00
PALMER Rte. 20 #19772	Safety Improvement	62,942.00
AGAWAM (2 Location) #19802	Safety Improvement	156,987.50
BOSTON-SOMERVILLE #19834	Inst. Impact Attenuation	280,701.00
OXFORD, Rte 20 & 56 #19927	Safety Improvement 0.2 Miles	270,391.25
WAREHAM #20076	Safety Improvement	97,310.15
WEST BRIDGEWATER Rte. 28 #20098	Safety Improvement 0.3 Miles	110,281.00
Total High Hazard	1.8 Miles	$1,541,763.90

PRIMARY RURAL (RF)

GRAFTON-MENDON Rte. 140 #19564	Guard Rail	109,736.00
GRANBY, Rte. 116 #19654	Road-Reconstruction 0.9 Miles	695,740.50
BOURNE Rte. 28 #19721	Road-Reconstruction 4.5 Miles	418,917.24
SHEFFIELD-GREAT BARRINGTON #19791	Guard Rail Replacement 9.4 Miles	224,302.25
Total Primary Rural	14.8	$1,448,695.99

SECONDARY RURAL (RS)

HARDWICK-NEW BRAINTREE/Ware River #19837	Bridge Reconstruction 0.2 Miles	$418,047.50
MIDDLETON #19877	Bridge Reconstruction 0.3 Miles	431,512.00
NEWBURY Elm Street #19929	Road Reconstruction 0.4 Miles	306,680.00
CLARKSBURG Rte. 8 #20072	Road Reconstruction 0.2 Miles	463,191.00
Total Secondary Rural	1.1 Miles	$1,619,430.50

ROADSIDE OBSTACLES (ROS)

BURLINGTON-TYNGSBORO #19762	Guard Rail Replacement 20.7 Miles	251,576.50
WEST STOCKBRIDGE-PITTSFIELD #19771	Fencing 8.4 Miles	130,699.00
Total Roadside Obstacles	29.1 Miles	$382,275.50

OFF SYSTEMS (OS)

CUMMINGTON-Bryant Rd. #19778	Construction 1.1 Miles	$501,498.25
Total Off Systems (OS)	1.1 Miles	$501,498.25

OFF SYSTEMS-Grade Crossings (OSG)

MIDDLEBORO-Plymouth St/Conrail #19869	Reconstruction 0.1 Miles	$306,396.00
Total Off Systems (OSG)	0.1 Miles	$306,396.00

SAFER OFF SYSTEMS-Grade Crossings (SOSG)

DOVER-Center Street Br. #20007	Reconstruction of Bridge 0.2 Miles	$348,597.00
Total SOSG	0.2 Miles	$348,597.00

SPECIAL BR.REPLACEMENT Second Rural (BR-RS)

STOCKBRIDGE-Glendale Middle Rd. over River #19491	Reconstruction of Bridge	$427,765.75
Total BR-RS		$427,765.75

SPECIAL BR.REPLACEMENT-CONSOLIDATED PRIMARY (BR-F)

MEDFORD-Somerville,Rte. 28/Mystic River #19840	Bridge Replacement	$3.648.040.00
CONCORD-Rte.62/Assabet River #19990	Bridge Reconstruction 0.1 Miles	547,051.00
Total BR-F	0.1 Miles	$4,195,091.00

SPECIAL BR.REPLACEMENT-URBAN SYSTEMS (BR-M)

FITCHBURG-Rallstone St. Bridge #19702	Reconstruction of Bridge	$273,491.50
BROCKTON-Grove St./MBTA #19738	Reconstruction of Bridge	364,124.50
Total BR-M		$637,616.00

ELIMINATION OF GRADE SYSTEM-URBAN SYSTEMS (MG)

BOSTON(East), Saratoga St. Br. #19845	Bridge Reconstruction	$399,720.00
BRIDGEWATER,High St./Conrail #19865	Bridge Reconstruction	324,404.25
NEEDHAM-Hunnewell/MBTA #20099	Bridge Reconstruction 0.1 Miles	285,115.00
Total MG	0.1 Miles	$1,009,239.25

URBAN SYSTEMS, MORE THAN ONE Fed.Route (M-000S)

AWRENCE-1 Location 19746	Bridge Deck&S.W.Reconstruction	$174,557.65
OMERVILLE-ARLINGTON 19764	Safety Improvements	303,371.25
NN-Western Ave.Rte. 129-107 9765	Safety Improvements	45,705.00
MERSET-11 Locations 9780	Safety Improvements	532,671.50
STFIELD-12 Locations 9805	Safety Improvements	698,291.40
BRIDGE-9 Locations 9815	Safety Improvements	319,050.00
ERHILL-Parking Garage 9816	New Maintenance Garage	1,610,995.12
LOW,East & Chapin Sts. 838	Safety Improvements	106,419.00
ELL-Towers Corner 339	Parking Lot 0.2 Miles	333,042.00
OUTH-13 Locations 355	Safety Improvements	843,654.00

URBAN SYSTEMS, MORE THAN ONE Fed.Route (M-000S) Cont'd

AMESBURY-9 Locations #19908	Safety Improvements	505,432.00
MEDFORD-7 Locations #19909	Safety Improvements	734,980.00
WESTWOOD-6 Locations #19910	Safety Improvements	259,645.00
ANDOVER,No. & So. Main St. #19989	Safety Improvements 2.4 Miles	190,000.11
Total M-000S	2.6 Miles	$6,657,814.53

URBAN SYSTEMS (U)

PITTSFIELD-2 Locations #19638	Roadway Reconstruction	526,437.55
Total U		$526,437.55

CONSOLIDATED PRIMARY (F)

AGAWAM-SPRINGFIELD #19734	Safety Improvements	$140,419.00
RANDOLPH-BRIDGEWATER #19820	Repl.Signs & Supports	412,486.00
BOSTON-Crosstown Sts. #19848	Demolition	17,955.00
NATICK-Speen St.-Rte. 9 #19870	New Bridge & Wall Construction 0.7 Miles	6,777,092.00
PLYMOUTH-DUXBURY #19873	Safety Improvements 1.0 Miles	9,178,361.00
DEDHAM-Rte. 1/128 #20016	Bridge Reconstruction	759,787.00
Total F	1.7 Miles	$17,286,100.50

BIKEWALK, SECONDARY RURAL (BWRS)

EDGARTOWN-OAK BLUFFS #19996	New Bikewalk 0.7 Miles	243,993.00
Total BWRS	0.7 Miles	$243,993.00

URBAN MASS. TRANSIT (UMTA)-(MA)

BRAINTREE-Capens Circle #068-111	Reconstruction 0.2 Miles	$4,857,886.00
Total MA	0.2 Miles	$4,857,886.00

100% STATE FUNDS

'IELD,Prospect St. Br. 558	Substandard Br.Replacement	$483,819.00
EFIELD, Rte. 128 559	Fencing 0.6 Miles	18,045.00
CKBRIDGE,Rte. 183/Housatonic 808	RipRap Repairs	51,032.50
OVER,Elm Street 843	Improvement for Discont. 0.8 Miles	426,468.00
SDALE,Old Dalton Rd. 871	Substandard Br. Replacement	271,666.15
ISBURY,Rte. 1/Merrimac River 872	Stone-Jetty	41,274.50
NSTABLE- BOURNE 873	Bus Shelter	8,350.00
RE,Rte. 122-32 889	Demolition	6,355.00
ERE,Bell Circle 914	Fencing 0.3 Miles	13,302.50
JRBRIDGE Rte. 15 9924	Demolition 0.1 Miles	6,982.72
STBORO Rte. 9 9928	Fencing 0.9 Miles	46,275.00
VERE 9935	Fencing	26,580.00
URNE Rte. 6-28 0006	Ped. Underpass	39,440.00
Total M-000S	2.7 Miles	$1,439,590.37

Contract Engineering

The Contract Engineer 's Section processes the bids for Federal Aid Projects requiring F.H.W.A. concurrence, State Highway Construction Projects, Chapter 90 Projects, Maintenance Projects, Boring Projects, projects for the construction, reconstruction, alteration, remodeling, repair, or demolition of buildings under the provisions of General Laws, Chapter 149; and Right of Way Projects involving the sale of houses, and the leasing of State-owned property, from bid opening to award of contract and maintains all the necessary records thereof. The Prequalification and post-qualification of contractors is administered by this Section and the issuance of Proposal Forms and plans to prospective bidders requires the approval of this Section. Force account agreements with public utilities, cities and towns are reviewed for approval.

MAJOR ACTIVITIES

1. At bid openings all proposals are publicly opened and read subject to verification for arithmetical correctness, examination for informalities and compliance with applicable statutes.

2. After a bid opening all proposals are immediately checked for compliance with requirements. Proposals that are unacceptable due to incompleteness, irregularities, collusion, qualifying clauses, etc., are duly noted and if the deviation is a matter of substance that is prejudicial to the rights of other bidders a recommendation for rejection of such bid is made on the other hand, a deviation may be merely a matter of form or some immaterial variation from the exact requirements that can be waived by the Commission under the right

MAJOR ACTIVITIES (CONT'D)

reserved. In the latter instance, if such bid is the lowest bid submitted, a recommendation will be made that the informality be waived and the project awarded to the low bidder as being in the best interest of the Department. After all bids have been checked and verified a "Summary of Bids" is prepared, printed and collated for distribution to interested Sections, Divisions, Districts of the Department, contractors who bid on the particular project, and local trade magazines and publications. Copies are retained for the Section's Records.

3. Letters recommending award or rejection are prepared and typed by this Section for the Chief Engineer's signature for presentation to the Board. Such letters are routed to our Fiscal Section for an assignment of funds. For work involving Federal funds, letters are also prepared and typed for the Chief Engineer's signature, requesting F.H.W.A. concurrence in the award or rejection of contracts as required by federal regulations.

4. Prequalification Statements submitted by contractors as required by General Laws, Chapter 29, Section 8B are analyzed, computed, and a rating determined for submission to our Prequalification Committee. Performance records of contractors who have previously performed work for this Department are maintained in this Section, and are designed to provide facts and documented data on every completed project and the contractor's performance. Such records provide a source of information for recommendations made by the Contract Engineer

MAJOR ACTIVITIES (CONT'D)

to the Prequalification Committee for the determination of Prequalification Ratings or limitations warranted by the facts.

5. For projects for which prequalification is not required, the low bidder and/or the lowest responsible bidder must submit a post-qualification statement, duly signed and sworn to, outlining his experience, equipment and financial resources on forms supplied by this Department. These post-qualifications statements are computed and analyzed exclusively by this Section and on the basis of the computation and analysis a recommendation for award or rejection is made to the Board.

6. Since the enactment of the Prequalification Statutes, all requests for Proposals and Plans for bidding purposes have to be cleared and approved by this Section. This policy was adopted so as to prevent the issuance of Proposals and Plans to contractors who are ineligible to bid because of failure to meet the requirements of the Prequalification Statute and Regulations.

7. Records of all activities of this Section are maintained for purposes of documentation and source of information.

(a) A complete alphabetical file of all contractors who have performed work for this Department is kept current at all times. This file shows the location of each project which the contract has performed, the advertising date, bid opening date, bid amount, date of award, and starting and completion dates.

(b) A card index file for each project awarded, showing date of advertising, opening of bids, date of award, office

MAJOR ACTIVITIES (CONT'D)

estimate, bid price, contractor's name and address, contractor's qualification, start of construction, date of completion, extensions of time, if any, and contractor's performance record.

(c) A card file of projects awarded in each city or town, showing name of contractor, type of project, and the starting and completion date of all contracts performed within the city or town.

(d) Prequalified contractors, their prequalification rating and date of expiration.

(e) A list of "Active Bidding Contractors" who submit bids for any project for this Department each calendar year is prepared and maintained.

CONTRACT ENGINEER SECTION

PROJECTS AWARDED FOR FISCAL YEAR ENDING JUNE 30, 1978

NUMBER	CATEGORY		AMOUNT
83	FEDERAL AID	$	108,736,899.00
11	STATE HIGHWAY CONSTRUCTION		1,403,629.00
19	CHAPTER 90 - STATE AID		4,686,115.00
365	MAINTENANCE		34,543,475.00
478	TOTAL	$	149,370,118.00

DURING THE FISCAL YEAR JULY 1, 1977 to JUNE 30, 1978 A TOTAL OF 392 CONTRACTORS WERE PREQUALIFIED.

FINAL REVIEW SECTION

The Final Review Section assumes the responsibility of assuring the Bureau of Public Roads, the Department, Cities and Towns, and the Contractors that quantities for payment are correct and equitable.

The processing of projects encompass the checking and reviewing of all field data recorded in survey books, pile driving book, mainifold book and quantity control ledgers to ascertain that all calculations, engineering and accounting are proper and correct. The interpretation of the Special Provisions as a compliment to the Standard Special Provisions determines the limitations of payments for each and every project. The project checking includes the analysis of survey notes and plotting of the same in order to obtain quantities for every conceivable item of excavation as well as fill areas by mechanical means. Recently the computer has been utilized for these quantities when possible and has enabled this section to expedite projects with added accuracy. Projects that appear to lack the required data or may be inconsistent necessitates a meeting with the Resident Engineer and/or his supervisor or assistants.

The initiation of pre-final teams which operate in the field at the time of construction of said project has been beneficial to the District, the Resident Engineer and this Section, because of instant answers resulting in quicker solution of any discrepancies which may exist. In addition, recommendations as to format may be offered prior to final entries by representatives of this Section.

The responsibility of the accuracy of an Extra Work Order or Claim after the Vote of the Board of Commissioners for an estimated amount, particularly when the work is accomplished at a cost plus basis, results in many meetings and conferences with the Resident Engineer and/or his Supervisor or Assistants, Construction Engineer and the Hearing Examiner and/or his assistants.

This section is subject to audits by the Bureau of Public Roads and State Auditors and the utmost cooperation is rendered to achieve this goal.

The following is a breakdown of the values of various types of contracts processed by the Final Review Section during the period from July 1, 1977 to June 30, 1978.

BREAKDOWN VALUE OF CONTRACTS PROCESSED BY THE FINAL REVIEW SECTION

VALUE OF STATE HIGHWAY CONSTRUCTION CONTRACTS:		
HAVING FEDERAL AID PARTICIPATION		
State Highway Construction	105 Projects	$67,631,748.67
Maintenance	14 Projects	1,514,117.39
VALUE OF STATE HIGHWAY CONSTRUCTION CONTRACTS:		
NON-FEDERAL AID	22 Projects	$ 3,986,854.95
VALUE OF STATE AID (CHAP.90) CONTRACTS	22 Projects	$ 6,018,466.63
VALUE OF MAINTENANCE CONTRACTS	319 Projects	$12,815,392.23
VALUE OF MISCELLANEOUS CONTRACTS (Incl. Consultant Services, Boring Contracts, Boston (P.W.B. CONTRACTS), Traffic, etc.	8 Projects	$ 274,042.22
	TOTAL=	92,240,622.09

An important factor, pertinent to the Commonwealth (Department of Public Works) and specifically to this Section, is that the grand total above includes the processing of a number of Extra Work Orders and/or Claims. These Extra Work Orders and Claims, proposed and approved by the Board of Commissioners, are subject to review and determination by this Section, often resulting in a savings of thousands of dollars.

A total of 36 Extra Work Claims were reviewed with a total decrease of $21,745.83± from the Claimant's submitted costs.

A total of 201 Extra Work Orders were reviewed resulting in a decrease of $1422.79± from the estimated costs. The extra work order summary reveals that although the overall saving was small, many were decreased an average of $2100 and one in particular decreased $30,012.00. Of course others increased due to quantities being estimated too low, and the largest increase was $102,999.50 for the past year.

This Section has been assigned the task of checking Bituminous Concrete Price Adjustment (Chapter 554 Acts of 1974) which amounted to $1,810,115.30 for 17 Projects and Price Adjustment (Chapter 857 Acts of 1974) in which 4 Projects were reveiwed for payment for a total of $192,384.96. Six (6) other Projects were reviewed and corrected and submitted to the Construction Division for acceptance and payment by Administration and Finance for a total of $142,718.02.

This Section has implemented, most recently, the procedure of processing Federal Aid Estimates with the Final Pay Estimates resulting in earlier Federal Reinbursements. Although this Office did process Federal Aid Estimates in the past, it was done at a later date.

HIGHWAY MAINTENANCE DIVISION

ANNUAL REPORT FOR 1978

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REGULATORY PERMITS

July 1, 1977 ---------- July 1, 1978

During the year the following permits were issued by the Boston Office:

	No. of Permits
Heavy Equipment, House Trailers and Buildings	18,603
Utilities	179
Driveways	46
Reducible load permits I.E. - Gravel, Stone, Bituminous Concrete and Oil etc.	6,737
Total	25,565

During Fiscal Year 1978, 12,805 permits have been issued via transceiver.

PERSONNEL

In Fiscal 1978 the Personnel Unit of the Maintenance Office accomplished the following.

Processed sixteen (16) Promotional Bulletins, and sixteen (16) Civil Service Certifications, for approximately 615 positions.

Processed Change in Status Forms for all Labor Service personnel for pormotions, leaves of absence, reinstatements, change in organization, classification, gang, address etc. Post and kept an active-up-to-date record of all personnel changes.

Interviewed approximately 95 applicants for appointment to the various positions within the official service, including Highway Repair Foreman, Bridge Repair Foreman, Lock and Draw Operator, Assistant Lock and Draw Operator, Electrician, Traffic Electrician and Communication Dispatcher, following Civil Service Certification.

Prepared recommendations for the signature of the Associate Commissioner for Administrative Services, the Deputy Chief Engineer for Highway Maintenance and the Maintenance Engineer relative to promotions and various other activities affecting field maintenance personnel.

Arranged for the Annual Maintenance Management Personnel meeting to clarify and resolve questions that come up throughout the year.

Prepared surveys of the staffing requirements within the Labor Service, including the preparation of the Maintenance Orgainization Chart.

Attended collective bargining hearings pertinent to labor service grievances.

Assisted in the classification study of Department positions in conjunction with the Governor's Task Forece recommendations.

Studied proposed legislation referred to the Maintenance Engineer. Attended all legislatvie hearings pertaining to these matters and maintained essential files of reference material.

Reviewed and prepared job specifications, and made recommendations regarding necessary revisions.

Assisted in the changeover of personnel assignment records to the computer.

MAINTENANCE TRAINING

As part of a comprehensive training program for Maintenance Personnel the following programs were conducted and coordinated for employees of the Labor Service.

WELDING PROGRAM

During the fall of 1977 a welding school was conducted at the Wellesley Maintenance Depot. The 108 hour course, attended by 25 students included cutting, flame welding and safety factors, focusing on preventative maintenance.

The fundamentals of arc welding and oxy-acetylne gas welding was covered, and instruction was given in correct and safe use of the welding processes.

SUPERVISORY REVIEW PROGRAM FOR FOREMEN

The program is currently being conducted for each District. The objectives of the program are:

1. To increase the capabilities of the first line supervisors - to organize, to supervise.
2. To instill a feeling of Departmental pride for good relations with fellow employees and with the traveling public.

Supervisory Review Program for Foremen (Cont.)

3. To disseminate guidelines on effective discipline and procedures in handling grievances.

4. To outline and define the responsibilities of the supervisor so he may see how and why he should fully carry out his duties proficiently.

MAINTENANCE MANAGEMENT

Massachusetts' Maintenance Management System design having been completed, is now in the process of being implemented. The implementation project was partially funded by the F.H.W.A. as a joint effort by Department Maintenance personnel and a consultant staff.

The System encompasses the planning, scheduling and reporting of all highway maintenance. Through seven computer programs and 15 separate output reports future performance budgets will be developed with appropriate conversions to line item form for legislative approval.

Due to personnel shortages the Field Assesment Unit has not yet been established but is planned for the future.

MMS Statistics & Analysis Unit

Fiscal Year 1978 has been a transitional period for the Statistics & Maps Unit. The absorption of this unit by the Maintenance Management Section has effected a number of significant changes in its operation. The publication and distribution of maps, a duplication of the efforts of other sections of the Department, has been discontinued.

At present, we are in the process of converting our highway maintenance records from conventional files to a computerized system. As the Maintenance Management System becomes fully operational, the duties of this unit will expand to include the detailed analysis of Maintenance Statistics and the preparation of budgets and other statistical reports necessary for the efficient and effective implementation of the M.M.S.

HIGHWAY MAINTENANCE

For the purpose of maintaining the roadway surface of our State Highway System, including drainage facilities, shoulders and guardrails, each of the eight Districts of the State is divided geographically, into working sections containing, as nearly as possible, ninety (90) lane miles of surface. Due consideration is given to the other pertinent factors, such as isolated sections of State Highway, physical barriers etc., and necessary temporary adjustments made during the procedure establishing the working sections.

Each maintenance section is staffed in accordance with a previously approved staffing formula within the limits of positions and personnel made available to the Department by others.

MAINTENANCE

Maintenance consists of routine physical maintenance work and betterment work. Physical maintenance consists of maintaining the highway and its existing facilities or restoring it to its originally constructed condition and includes surface treatments of thin bituminous concrete overlays of less than 3/4" in depth.

Betterments include improvements and additions to the originally constructed highway, such as drainage and guardrails, and includes overlays of 3/4" depth and over. These represent capital outlays.

Physical maintenance and betterment projects are carried out both by using Department Forces and by contract. As our lane mileage increases each year, due to a lack of sufficient personnel, and in the interest of economy and allowable time, most of the major items of maintenance, either physical or betterments, are being performed under advertised contracts.

MAINTENANCE (CONT.)

The substance of this report will deal primarily with a summary of major items of physical maintenance carried out by contract, including resurfacing.

PHYSICAL MAINTENANCE

Routine maintenance operations were carried out by Department Maintenance Forces, and included such operations as minor shoulder repairs and certain shoulder or surface treatment with liquid bitumen and sand or stone cover. The regular program prepared to carry out surface treatment throughout the eight Districts of the State by the application of Class I Bituminous Concrete Type S.T., was not carried out the past several years due to lack of funds.

The Department has no maintenance depot or personnel located on the Island of Nantucket. Therefore, maintenance of the only State Highway (Milestone Road) on this Island has been carried out by the Town of Nantucket under a contract with the Department. The sum of $10,000.00 was allotted for this work.

Three (3) Betterment Projects were carried out by contract during the year at a total cost of $75,430.00. Project work involved one (1) new co-operative sidewalk and two fence and curbing installations. This amount was financed from the Accelerated Highway Program.

One (1) Physical Maintenance Project, consisting of Pavement Crack Sealing, was carried out by contract in District One at a cost of $27,000.00.

RESURFACING

No funds were appropriated for the regular Maintenance resurfacing account for Fiscal Year 1977. However, funds were made available from the Accelerated Highway Program.

Accordingly, a total of eighty six (86) contracts were awarded during the year for the resurfacing of approximately two hundred and fifty-three (253) miles of highway with Class I Bituminous Concrete Type I-1, varying in widths from 24 feet to over 60 feet and varying in depth from 3/4" to 3" at a cost of $24,412,000.00.

Considering the fact that the two thousand eight hundred and eighty-two (2882) miles of highway surface has an average life span of fourteen (14) years, it requires resurfacing an average of 200 miles each year in order to maintain the present highway pavements. It is evident that, even with the aid of Accelerated Highway Funds, additional monies must be constantly devoted to resurfacing in order to maintain an adequate level of service.

During the five (5) year period 1974-1978, a total of 712 miles out of theoretical 1,000 miles were resurfaced. Thus, the resurfacing program is operating with a 29% deficiency and should significantly be increased to prevent this constantly increasing gap.

GUARD RAIL REPAIR AND RESTORATION

Through the use of Federal Funds, damaged guard rail on approximately 70 miles of State Highway was repaired and/or restored. These funds consisted of $262,800.00 from the Removal of Roadside Obstacles Program, and $347,000.00 from the High Hazard Safety Program.

MISCELLANEOUS

Preparation of the report on "Quotation Prices per Ton for Bituminous Concrete Patching Mix Furnished and Loaded at Plant" was expedited by the use of a Computer Program developed several years ago. The annual advertising date coinciding with the Fiscal Year has proven to be more effective.

The ever increasing traffic volumes, both rural and urban, plus the anti-skid type (studded) tires, tend to deminish the effective life of a pavement, thereby, increasing the frequency of the need for resurfacing.

Delay in obtaining adequate funds for surface treatments at the time they are initially proposed frequently results in deterioration of the surface where resurfacing becomes necessary at a much greater expense.

Our present Fiscal Year Calendar, although compatible with fiscal operations State-side, is not in reality conducive to the most economical or efficient method of Highway Maintenance. Due to the seasonal limitation it would seem more benefical to utilize the "construction season" for construction, and the winter season for planning, instead of the present exactly opposite procedure.

Therefore, it is recommended that:

1. Appropriations for proper maintenance of our Highway System should be in balance with the normal requirement for same.

MISCELLANEOUS (CONT.)

2. Such steps as necessary be taken from time to time to encourage the legislature to make provisions for the preceding recommendation by making them constantly aware of the need.

EXPERIMENTAL WORK

The Federal Highway Administration has been promoting the use of an open-graded plant mix resurfacing coat for the past few years on pavements that have a history of skidding accidents or low skid test numbers.

Last year, as done in the previous years, the Department designed and awarded several resurfacing contracts that included open-graded plant mix which may become a Department Standard for correcting specific pavement problems.

In the interest of conserving the use of energy in highway maintenance work, several resurfacing projects utilizing asphalt emulsion were constructed in different areas. The results of the previous year give every indication that this material may greatly influence future resurfacing programs.

Other uses of new methods and materials in the field of Highway Maintenance that have been utilized over the past year, have been:

a) Pavement removal by the cold planing process

b) Preformed plastic pavement markings

c) Crack reflection retardation by use of flexible membranes

d) Night paving of a major highway.

ROADSIDE MAINTENANCE

Activities carried on by contract under the Maintenance Section Roadside Development Unit during the Fiscal 1978 consisted of the following work: Mist Blower Spraying - Poison Ivy Spraying - Drainage Ditch Spraying - Providing Roadside Sanitary Facilities - Travel Trash Collection - Grass Mowing, Tree Trimming, Tree and Stump Removal.

Normal Force Account Roadside Maintenance activities, such as Vista Clearing - Selective Clearing and Trimming - Brush Control for Safe Sight Distance - Emergency Tree Removal and Trimming - Litter Pickup - Rest Area and Truck Turnout Improvement - Drainage Ditch Clearance and Spraying - Soil Sterilant Spraying - Mist Blower Spraying and Grass Mowing were carried on in all Districts.

The Cooperative Research Program sponsored jointly, by the Massachusetts Department of Public Works, Federal Highway Administration and the University of Massachusetts, Department of Plant and Soil Sciences of the College of Agriculture has produced and is continuing to produce demonstrative results. Slope plantings, in several Districts, of native seeds, root cuttings, evergreen seedlings, sweetfern, Crownvetch, Flat Pea and other container grown plants have been made as a direct result of the findings of the Program. All are showing remarkable improvement to stabilize slope erosion and to minimize the expensive mowing requirements. Woodchips are known to be very satisfactory in the control of erosion on slopes.

To restore the forest floor in Rest Areas, we used aged bark mulch and wood chips. This was very successful. The Roadside Unit is constantly striving to keep informed of all the latest practical and cost saving methods in order to maintain the necessary maintenance of our Highways.

The Highway Landscape Supervisor, in the capacity of Technical Advisor to the Research Program is able to direct efforts in the field on combating erosion through planting material in the various environments and soil conditions of the State. He was also the representative of the Commissioner on the State Pesticide Board and in this position has access to first hand knowledge of desirable and undersirable chemicals used in destruction of harmful insects, weed control and soil sterilization along with instructions in their safe usage.

In the Pesticide Board, recently established by the Legislature, the Commissioner of the Massachusetts Department of Public Works was omitted from the Board. Legislation is being submitted to the 1979 Legislature to have the Commissioner appointed to the Board.

Applications were also made under Title VI of the Compreshensive Employment and Training Act as it pertains to the Emergency Jobs Programs Extension Act of 1976. The applications were made to CETA Prime Sponsors and the Balance of State Prime Sponsor Subgrantees. Favorable consideration was received from some of the Subgrantees and employment under these Grants began in Fiscal 1978. The laison officer for the Department is assigned to the Roadside Maintenance Unit.

Eleven grants were received from Prime Sponsors and Balance-of-State Prime Sponsor Subgrantees. In June of 1978 a total of 268 employees were actively employed by the Department so that they may receive training for future employment.

Removal of Tree and Stumps

Dead, diseased and dangerous trees are removed in the interest of highway safety. Removal of trees that are affected with Dutch Elm Disease is mandatory under the law. Trees that may present hazardous conditions should be removed to protect the public and avoid liability for the Department.

District	Number of Contracts	Trees Removed	Cost
1	2	334	$44,152.00
2	2	241	40,111.00
3	3	442	26,171.00
4	2	372	33,422.00
5	2	159	14,101.21
6	1	311	16,792.00
7	3	367	32,365.00
8	1	71	2,915.00
Totals	16	2297	$210,029.21

No contracts were awarded in Fiscal Year 1977 so the condition of the trees was such that a serious safety hazard existed. It is strongly recommended that every effort be made to assure that sufficient monies are available for a tree and stump removal contract in Fiscal 1979.

Mist Blower Spray For Suppression of Dutch Elm Disease

This work was accomplished by contract in Districts 1, 2, and 8 while Districts 3-7 undertook this work by Force Account. The cost of three contracts totaled $17,456.00. Spraying all Elm trees along our roadsides is necessary to

protect them from the ravages of Dutch Elm Disease which is spread by the Elm Leaf Beetle. Spraying for suppression of Dutch Elm Disease is a mandate by Law.

Poison Ivy Spraying

This work was accomplished on a State-wide basis under eight (8) separate contracts at a cost of $37,635.36. Spraying for the eradication of poison ivy is maintenance work required by Law.

Contract Erosion Control Planting

No contract work was accomplished this year because of insufficient funds.

The trees, seedlings, lining out stock and container grown planting is part of our relentless struggle to control erosion.

Tree Trimming

Dead, diseased and dangerous limbs are removed in the interest of safety to the traveling public and the health of the trees.

This work was accomplished on a Statewide basis with seventeen separate contracts at a cost of $198,907.00.

Travel Trash Collection

Travel trash collection is done in the interest of public health and part of our program to keep 237 Roadside Rest Areas clean. Six contracts were awarded in 1977 for the collection and disposal of travel trash through Contractor furnished containers using Packer Type Trucks. Nine contracts were awarded in 1977 for emptying of Department owned barrels. All contracts were for Fiscal Year 1978. The total cost for all fifteen contracts for the 1978 Fiscal Year was $136,798.39

Mowing of Grass Along State Highways

The Mowing Program was severely cut back, in Fiscal 1976, to the point where it is now a substandard Program. The number of cuttings on Limited Access Highways was reduced from four (4) or two (2), while the mowing of the secondary roads was eliminated. No contract mowing was performed in Districts One and Two.

In Fiscal Year 1978, three mowings were performed. The grass was cut in the fall, spring and summer.

Twenty-five (25) contracts were awarded for the remaining Districts at a total cost of $561,223.00.

Roadside Spraying & Liquid Fertilization Spraying of Grass

No contract work was accomplished this year because of insufficient funds.

The purpose of this work is to eradicate weed growth and fertilize specified areas of various roadsides, medians and rotaries which are maintained as mowed grass areas.

Wood Chip Utilization

Wood chips have been used effectively for the past several years for slope erosion. Because of a "no burning" law in Massachusetts, the Department of Public Works plans doing more of our State Highways with all the available wood chips that will be stock piled either in our pits or close to the job for use whenever possible. Over 500 miles of slopes and other areas have been successfully planted and mulched. This method of

treating slopes has reduced mowing costs over areas that are all grass on roadsides and along slopes. Chips at a 3" depth in conjunction with the new environmental approach of covering slopes immediately under the prime contract is a natural and practical solution of our erosion problems. There are thousands of cubic yards of wood chips available from construction projects for Roadside Development resulting from trees removed by clearing and grubbing as well as selective clearing and thinning.

Container Grown Plants

This program was substantially reduced this year, due to budgetary restrictions. It is estimated that 10,000 container grown plants were planted along the slopes of the State Highways to control erosion. This practice has proven to be quite successful and should be implemented at a much larger scale.

Drainage Ditch Spraying

Districts Three through Six were each awarded one contract each for the custom chemical spraying of grass and weed growth in drainage ditches. The purpose of this spraying was to eradicate the grass and weed growth within the flow area or wetted perimeter of the drainage ditches to provide for free flowing surface water and drainage and eliminate a possible harborage for rodents. The bid price for this totaled $58,013.00. It is desired that this program be funded on an annual basis to complement the spray work being done by our Maintenance Forces.

Ditch Clearance

Obstructions to flow in drainage ditches contribute to soil erosion along our highways and inefficient flow of drainage system discharge. This year vegetation in existing ditches was sprayed by District Forces. Current obstructions in ditches should be cleared away under contract as the 1800 miles of ditches is too much to ask our already undermanned crews to attempt along with their other necessary duties.

Preventive Roadside Maintenance

Developing preventive maintenance into 60,000 acres of land that abut the 2,800 miles of State Highway, which was originated several years ago, is still being pursued through wood chip mulching and planting of many areas, State-wide, with over 30 species of hardy seedlings, shrubs, ground cover, container grown plants, native seeds, natural growth sods and trees, contingent upon the availability of funds. When the ecology is right, natural growth is induced to fill in the planted area to present naturalistic roadsides.

Selective Clearing For Safety And Sight Distance

No contract work was accomplished this year because of insufficient funds.

This is for the improvement of the horizontal and vertical sight distance and recovery area adjacent to the travelled way. In addition removed tree material is reduced to wood chips for use in erosion control and planting by the Department.

In the interest of maintaining safe highways and increasing the aesthetic

values, special attention was given to the following:

1. Exposing guard rail which may be screened by grass, brush or trees.
2. Reducing the number and extent of passing restrictions.
3. Widening the roadside area at natural turnouts and off-the-highway parking which are on the older State Highways.
4. Opening up scenic vistas.
5. Raising the branch level of trees to give 20 feet of height clearance.
6. Improving the visibility of all traffic signals, lights and signs.
7. Improving visibility in the vicinity of driveways and intersections.
8. Improving the general appearance of the roadside.

Roadside Sanitary Facilities

Seven (7) contracts were awarded to provide portable roadside sanitary facilities at specified rest areas in the amount of $ 38, 332. 00.

A decrease in availability of funds reduced the amount of facilities provided and locations served since the 1976 Bicentennial Year.

This service should be increased in forthcoming years.

Construction of Roadside Rest Areas

Modernization of existing rest areas and the critical need of construction of new facilities is considered essential in promotion of travel. Many of our existing rest areas are currently being used beyond a practical capacity.

Certain locations, State-wide, were selected for Roadside Rest Area Construction under the Administration of past President Johnson's Beautification Program. It is apparent that no funds will be forthcoming under this program and other arrangements must be made to provide these critically needed areas as soon as possible.

Recent field observations indicated that we do not have a sufficient number of Rest Areas on some routes. The existing facilities are being

put to near capacity use by drivers of both passenger cars and trucks. Weekend observations noted double the usage and a definite lack of sufficient facilities.

Land values are rising rapidly particularly near new expressways. Further delay in obtaining land and designing areas will make for high cost in future construction. Action should be taken now.

Rest Areas (Maintenance and Improvement)

The Roadside Maintenance Sections in Boston and in all Districts are constantly working to improve the aesthetics, facilities, service and environs of the Rest Areas on State Highways.

Tourism is a major industry in the Commonwealth and the "Rest Area" is the most functional selling point to the motoring public when its services are needed.

In an attempt to reduce maintenance cost, various Districts have undertaken Programs on an experimental basis. Among the programs underway is a method of permanently positioning picnic tables by using steel beam guard rail posts as anchors; selective clearing and thinning of rest area immediate application by machine of wood chips to the entire area to reduce mowing and brush control; and other programs.

Annual maintenance consists mainly of repainting trash barrels and refurbishing picnic tables. Materials are puchased annually for this work. Replacement of missing or damaged barrels and tables is made as funding permits. This year four hundred (400) tables were purchased for use in the 237 Rest Areas throughout the State.

In an effort to maintain a clean and healthy Rest Area, Travel Trash Contracts for the removal of accumulated rubbish from the barrels and contractor-owned containers are awarded annually under the Maintenance Program. Inspection of the contents of the filled barrels and containers sometimes makes one suspect if the rubbish is associated with "travel" or "household".

A properly maintained rest area is an integral part to a complete Massachusetts Highway System and the enjoyment of the scenic environ of the State.

Litter - Blitz Litter Week

Major emphasis was given to the cleanup of litter and debris along the State highway system during the first week of May. All of the Department maintenance personnel in the highway, traffic, roadside and bridge sections were used for the cleanup of litter.

STRUCTURES MAINTENANCE

BRIDGES

As of July 1, 1978, the Department had maintenance responsibility for a total of 2726 bridges, having a total workload area of approximately 2,800,000 square yards.

All Bridges for which the Department has responsibility have been inspected at least every two years since the inception of the program. Underwater inspections have been made on a "requested" basis. A program is now being implemented to insure regular underwater inspection in conjunction with above water inspection. Salt corrosion and "Half Cell" deck tests are now programmed on a regular basis.

Recently acquired Railroad Bridges have been inspected and programmed for repair, demolition, or replacement.

Computer programs have been made available to District Structures Maintenance Personnel through the District Computer Terminals to enable faster response to questions, concerning various Bridges.

Communications Towers have been inspected and programmed for repair and regular maintenance.

The following sections although not all "inclusive" will give some indication of the magnitude of typical operations.

CONTRACT BETTERMENT PROJECTS

City or Town	Location	Type of Work	Cost
Wareham	Onset Ave./ Swifts River	Underwater work and Bleeders, etc.	48,750.00
Holyoke - South Hadley	Route 202/ Conn. River	Bridge Deck Betterment	130,440.00
Boston	Congress St. on Ramp (N.B.)	Bridge Deck Betterment	65,740.00
Blandford	Route 23/ Peeble Brook	Bridge Deck Betterment	49,640.00
Boston	J.F.Fitzgerald X-WAY Conrail, Amtrack & Mass. Turnpike	Bridge Deck Betterment & Special Overlay	217,880.00
Concord	Route 2/ B & M R.R.	Temp.Support for Superstructure of Bridge	21,000.00
Freetown	Route 24/ Assonet River	Bridge Deck Betterment and Slope work	37,770.00
North Adams	Route 2/ Hoosic River	Bridge Deck Betterment	132,680.00
Boston	Route I-93 & Rte.3/Railroad, Mass. Turnpike, Broadway and West Fourth St.	Bridge Deck Betterment	611,440.00
		TOTAL	$1,315,340.00

CONTRACT PROJECTS ON CHAPTER 634 RAILROAD BRIDGES

City or Town	Location	Type of Work	Cost
Westborough	Holmes St/ ConRail Corp.	Demolition of Railroad Bridge	24,940.00
North Adams	State St/ Hoosic River & P.C.R.R.	Bridge Deck Betterment, Inc. Install Elastomeric Expansion Joints	437,600.00
Bernardston	Route 5/ B & M R.R.	Bridge Deck Betterment, Inc. New Bridge Railings	81,200.00
		TOTAL	$543,740.00

CONTRACT MAINTENANCE PROJECTS

City or Town	Location	Type of Work	Cost
Boston (District 8)	State Hwys.	Electrical Maint.	27,060.00
Oaks Bluffs - Tisbury	Beach Road/ Lagoon Pond on Martha's Vineyard	Drawbridge Opertion and Maintenance	4,520.00
Florida - Savoy	Route 2/Cold River	Bridge Deck Repair	51,720.00
		TOTAL	$83,300.00

UNDERWATER OPERATIONS

In addition to conducting underwater bridge inspections, the dive team expanded its normal routine, to make emergency repairs to the Wareham Narrows Bridge. The nature and difficulty of the work illustrates the versatility of the dive team and the benefit of proper training and equipment. It also exemplifies the willingness of the divers to cope with adverse conditions in the performance of their duties.

The bridge was closed by the Department after a routine underwater inspection disclosed nine (9) "H" piles which were 80% deteriorated below the mean low waterline.

The repair consisted of spanning the deteriorated section with a specially fabricated ½" steel plate, which weighed 250 lbs. and measured 7' x 1'. Each plate had 40 predrilled bolt holes.

An oxgen-arc underwater torch, powered by a 300 AMP welding machine was used underwater to cut the bolt holes in the flange. A plywood template clamped to the flanges served as a guide during the cutting operation.

The holes were relatively smooth and generally conformed to the template. The 250 lb. plates were jockeyed into place with a come-along. The bolts were hand tightened and torgued with a pneumatic drill.

The work was performed during the Winter with an average water temperature of 31°F.

The selectmen of the Town of Wareham and the local State Representatives commended the Massachusetts Department of Public Works for expeditiously completing the repairs and re-opening of the bridge.

EXPERIMENTAL WORK

The experimental work of the Structures Maintenance Unit has been limited to evaluation of rapid setting concrete patching material. Duracal, manufactured by U.S.Gypsum Co., is most favored and accepted by the majority of the districts and was used as a basis for comparison. The two (2) products tested were (1) Tigercrete, manufactured by Garon Products, Inc., and (2) Set 45, manfactured by Set Products, Inc.,

Set 45, a magnesium phosphate concrete, appears to be performing well, especially in near-freezing and sub-freezing temperatures.

Tigercrete, which in its initial field testing showed much promise, has since become a failure, as it develops a flash set and then does not develop a rapid set, the prime requirement for a rapid setting patching material.

CIVIL DEFENSE

The Department of Public Works has continued to provide liason and staff support to the Massachusetts Civil Defense Agency.

The Department provided assistance as required during the Storm of January 20, 1978.

The major contribution of assistance by the Department to MCDA was during the '78 Blizzard when all Agencies of the State worked with MCDA during the declared "State of Emergency".

CIVIL DEFENSE(CONT.)

Department personnel attended seminars on Basis Civil Defense and Nuclear Civil Protection.

COMPUTERIZED MASTER BRIDGE INDEX

Work continued throughout the year to update this file. The new FHWA Data Format was incorporated for reports to Washington, D.C. Work was started on relating bridges over defense highways to the inventory route (for defense highway clearance data and vulnerability). Work will continue to correct inventory data and update appraisals as field data is received.

General

Liaison work with the districts continued throughout the year. Assistance was supplied to the various districts in problem areas and contract as well as force account bridge repair.

Design of the Glued-Laminated Timber Bridge was completed and details forwarded to the Bridge Engineer.

Districts were informed of proper configurations of timber bridge repair details to obtain maximum rating possible on various railroad bridges throughout the state.

Various materials and equipment was obtained for the districts to facillitate bridge maintenance by central purchasing and re-distribution.

INSTALLATIONS FOR FUEL SERVICE FACILITIES

The following contracts were completed for the installation of Fuel Service Facilities at state wide maintenance sites:

1). Districts 1, 2 & 3

2). Districts 4, 5, 6 & 7

The contracts contained 77 tanks for diesel, regular and non-leaded fuels. With the department's 98 fuel locations it is now possible for other state agencies to draw fuel from Department Fuel Centers. The following chart "Fuel Statistics" give districts and state wide breakdown on fuel data:

FUEL STATISTICS

DISTRICTS	NO. OF TANKS PRIOR TO 1978	NO. OF TANKS INSTALLED IN 1978	TOTAL NO. OF TANKS	CAPACITY IN GAL. PRIOR TO 1978	CAPACITY IN GAL. INSTALLED IN 1978	TOTAL CAPACITY IN GAL.	REGULAR FUEL CAPACITY IN GAL.	DIESEL FUEL CAPACITY IN GAL.	NO LEAD FUEL CAPACITY IN GAL.	FUEL SITES
1	11	8	19	53000	64000	117000	54000	50000	13000	10
2	23	6	29	115000	48000	163000	69000	76000	18000	14
3	13	19	32	65000	152000	217000	110000	86000	21000	16
4	24	5	29	153000	40000	193000	109000	66000	18000	14
5	16	2	18	101000	16000	117000	64000	35000	18000	9
6	9	26	35	44000	208000	252000	123000	100000	29000	17
7	17	10	27	101000	80000	181000	93000	54000	34000	12
8	8	0	8	41500	0	41500	26000	15500	0	4
* W	2	1	3	15000	8000	23000	10000	5000	8000	1
* B	1	0	1	8000	0	8000	0	0	8000	1
TOTAL	124	77	201	696500	616000	1,312,500	658000	487000	167000	98

* W- WELLESLEY
* B- BOSTON MOTOR POOL
APRIL 1978

DRAWBRIDGES

The Department had operations and maintenance responsibility for seventeen (17) Drawbridges located over navigable waters.

LOCATION OF DRAWBRIDGES	OPENING DURING FISCAL 1978
Amesbury - Deer Island Bridge over Merrimack River	70
Beverly - Salem, Route 1A over Danvers River	1121
Beverly - Salem, Kernwood Avenue over Danvers Rivers	1502
Beverly - Hall Whitaker Bridge over Bass River	24
Gloucester, at Blynman Canal Route 127 over Annisquam River	9,314
Haverhill - Groveland, Route 97 over Merrimack River	19
Haverhill - West Newbury, Rocks Bridge over Merrimack River	24
Newbury - Plum Island Turnpike over Plum Island River	182
Salisbury - Newburyport, Route 1 over Merrimack River	295
Fall River - Somerset Brightman Street over Taunton River	1143
New Bedford - Fairhaven, Route 6 over Acushnet River	627

DRAWBRIDGES (CONT.)	OPENING DURING FISCAL 1978
Quincy - Weymouth, Route 3A over Weymouth Fore River	676
Westport - Route 88 over Westport River	84
Scituate - Marshfield, Route 3A over North River	7
Tisbury - Oak Bluffs, Beach Road over Lagoon Pond on Martha's Vineyard Island	338
Boston - Milton, Granite Ave - Route 3 over Neponset River	930
Lynn - Saugus, Western Avenue over Saugus River	3,912
TOTAL OPENINGS	20,268

CLEANING AND PAINTING OF BRIDGES

The cleaning and painting of bridges is one of the most important operations in the Structures Maintenance Unit. It is preventive Maintenance in that it preserves and protects the initial investment.

During Fiscal 1978 Seventeen (17) contracts were awarded for the cleaning and Painting of forty (40) bridges - a total of $391,780.00.

TRAFFIC MAINTENANCE

GENERAL

During Fiscal Year 1978 the Traffic Maintenance Unit was able to close the gap slightly between the maintenance that needs to be done and the maintenance that is actually done on Traffic Control Devices. This was possible primarily through the receipt of Federal Funding in certain areas and an increase in at least one of the Maintenance Accounts (Pavement Markings).

The Traffic Maintenance Unit finds itself falling further behind in the electrical maintenance area and this is primarily because of lack of sufficient personnel particularly in the Staff area to administer this technical work. One program that bogged down the electrical maintenance staff work was the Motorist Aid Call Box Maintenance Program. The electrical Maintenance Engineer had to serve as Resident Engineer for the Call Box Maintenance Contract in District 3, 4 and 5. This practice will be discontinued in the future., the Districts will have to provide a Resident Engineer for these combined contracts.

The following are the Fiscal Year reports for the major activity areas in Traffic Maintenance.

I. TRAFFIC SIGN MAINTENANCE

A. BREAKAWAY SIGNS

Fiscal Year 1978 saw the completion of a major maintenance

effort to replace the fixed sign supports that hold the small directional signs (4' x 5') with breakaway supports. In the process of doing this it was also possible to renew most of these signs and this was much needed. The FHWA participated in this program under the Federal Highway Safety Act. Expenditures in the program exceeded 3 million dollars over the past three years.

There are many more directional signs to replace and there will continue to be signs to replace or refurbish. Since signs are erected on a continuing basis they wear out on a continuing basis. The replacement of fixed sign supports with breakaway supports not only has increased the safety of the traveling public but it has helped to close the gap that had developed in the timely replacement of these signs.

A contract was awarded in December of this year for the installation of breakaway signs on a statewide basis. This program will introduce a new model of breakaway support connection which will allow the post to "fail" when hit from any direction instead of "failing" when only hit from one direction as it does now.

This year's contract is estimated to cost $197,000.00 and follow much the same format as the larger contracts issued during the past three years. It is estimated that an annual expenditure in this area of between $150,000.00 and $200,000.00 will provide sufficient resources to carry on a satisfactory directional sign refurbishment program. This is in addition to those signs that are put up annually by State Forces.

Since the anticipated life of a sign face is 10 years it is further determined that in future mid-decades(84 - 85 - 86) there will have to be increased sign refurbishment funding to again maintain the small direct-

ional signs that were refurbished during the past three years.

B. SIGN WASHING

Three of the eight Districts chose to have their sign washing done by contract this year for a total cost of $13,250.00.

The added sign reflectivity that is gained for the motorist through this basic sign maintenance routine is well worth the monies expended.

For those Districts that lack the personnel to complete this work on a Force Account basis the contract is a good alternative. Analysis indicates that the Contractor can perform this work more efficiently than State Forces because of the efficient washing equipment being used by the Contractor.

C. REPLACEMENT - MILE MARKERS, 1/10 MILE MARKERS AND DELINEATORS

Traffic Maintenance Forces continue to be frustrated by the Maintenance of Roadside Traffic Devices such as mile markers, 1/10 mile markers and delineators. There is increasing importance being placed on the mile and tenth markers. Most highway physical features are being identified by this system, as are computerized accident location statistics.

These locations are becoming so important that maintenance forces are continuing the practice started last year to paint the mile and tenth locations on the edge of the highway, as well as erecting the post marker.

The frustrating part of this work that the post mounted markers and delineators are significantly damaged by plowing and mowing operations.

This problem is of such magnitude that there are several companies trying to develope an efficient flexible delineator that could take several hits and return to operating position.

Fortunately, the FHWA has decided to provide funding to replace these roadside objects that become damaged. Under a pilot program that was in effect during Fiscal 1978 the Department spent $108,000.00 on this activity in the 8 Districts.

During the past year new design standards called for the markers and delineators on the median side of a divided highway to be amber color to match the median edgeline. Markers and delineators adjacent to a white edgeline must be silver or white in color.

As a result of a maintenance suggestion the mile and tenth of mile markers were placed on the median side of divided highways, it is felt that this will reduce the vandalism experienced with the markers along the right side of divided highways.

D. EXPERIMENTAL (SIGN)

For the past several years the Department has specified one model of sign post for the smaller signs (up to 20SF). This post was demonstrated to safely yield on impact and had a high salvage value. The scrap portions of the post were much like parts of an erector set, and could be used for shelves, brackets, braces etc.

Another post has now appeared on the market that will readily yield when struck by vehicles. This post is a flange channel post that has a retainer strap attached at the base. Although this post appears to have

less utility than the standard P-5 telescopic tubing there is no denying that it appears to perform adequately as a sign support. During 1978 several demonstrations of this support system were conducted in the Districts. The new post costs approximately 15% less than the former post.

E. VANDALISM

One area of vandalism started to occur this year that has not been evident before. A few of the 4' x 5' plywood signs are reported missing. The sign panel fastening system will have to be reviewed to prevent this activity.

D. SIGN ORDERS

There was a slight increase in the sign orders this year with the Districts submitting approximately 1260 separate orders. There can be several signs on one order so that figure does not indicate how many signs were fabricated. Traditionally, however the sign fabrication shop at the Wellesley Maintenance Depot fabricates in the vinicity of 100,000 square feet of signs per year.

The sign fabrication shop is completing an update of their sign fabrication equipment so that it has the potential to manufacture any sign required on the Highway. Unfortunately there is probably no area that has a greater lack of qualified help in the maintenance organization than the Traffic Sign Shop. As skilled technicians leave this operational area they are not being replaced. This is one of many organizational

inconsistencies. One facet such as the equipment will be excellent and another directly related function such as sufficient personnel will be sadly deficient.

II. ELECTRICAL MAINTENANCE

A. TRAFFIC SIGNALS

Only three traffic signal reconstruction projects were processed this year. There are a few different reasons for this reduced activity. First, the Districts are busy designing other projects such as those under the former Topics Program.

Another reason that the designer did not process any of the State Highway Traffic Signal reconstruction projects during 1978 is that a statewide program is being assembled to reconstruct several of the non-standard signals in the vey near future.

The Traffic Engineering Section is in charge of this program and the contracts will be processed through the Traffic Maintenance Unit.

As a result of this proposed work it is estimated that there will be sharp increase in traffic signal reconstruction during Fiscal 1979.

The Traffic Maintenance Unit continued to review the "Traffic" plans and specifications that involve state highway installations. This review not only involves signal installations but pavement markings and signs as well.

B. HIGHWAY LIGHTING

An efficient highway lighting maintenance program continues to elude the Traffic Maintenance Unit. The reason for this is simply a lack of additional technically qualified help. It takes either a person with an electrical background or a person who has been exposed to the electrical field to adapt to this type of work. Until this type of personnel can be secured or until the Electrical Maintenance Engineer's workload can be reduced it is going to be difficult to improve on the Maintenance of Highway lighting on State Highways.

An anticipated troublesome area of lighting maintenance at the present time centers around the tower lighting. Construction projects containing these 100' + installations continue to be plagued by malfunctions.

Recently a separate contract had to be issued to repair a particular installation. This was due in part to poor field follow-up but it can be seen that this area might be more efficiently maintained by contract.

C. EXPERIMENTAL

The Traffic Maintenance Unit continued its evaluation of the Fiber-Optics Pedestrian Signals in Northbridge at the intersection of Route 122 and Church Street.

These type of signals emit light through small bundles of fibers and are very efficient to operate. These signals use about one half the power of ordinary incandescent pedestrian signals. These signals are also much less prone to vandalism since it is possible to fracture one part of the light

lens and the other fibers will still operate.

Total operating expenses for these signals, including installation, places them at only slightly less costly than the incandescent fixtures. This is due primarily to the difference in cost of hardware between the the two types of units.

The Fiber-Optic System should be very efficient for lighted curve warning signs, where there is usually more vandalism than on pedestrian signals. Test installations will be made on warning sign units.

III. CALL BOX MAINTENANCE

The Maintenance Section is now responsible for the maintenance of 840 call boxes on various interstate highways in the Commonwealth. This work includes the maintenance of the associated microwave system as well.

During Fiscal 1978 $228,000.00 was spent on keeping the call box system in operation. Some relief in the funding of this maintenance has been received from the FHWA. Federal funding is received for the repair of call boxes that are damaged by vehicular hits.

There are still some question as to the complete necessity of this system. The proliferation of CB radios in vehicles has made assistance much more available to the stranded motorist than ever before. At least one state has abandoned their call box system for CB radios in all state vehicles and police vehicles. A CB radio costs in the vicinity of $135.00 each and a call box costs approximately $3,500.00 each. If last year is any criteria it further costs $270.00/year to maintain the call box.

This high maintenance cost is due in good part to the damage incurred during statewide snow removal operations.

A major drawback to the call box system at the present time is the lack of "in house" technicians for maintenance and the lack of a separate individual in the traffic maintenance unit to devote full time to this activity. The Electrical Maintenance Engineer is managing this activity at the present time and since he had to serve as Resident Engineer on one of these contracts this year, the call box maintenance activity occupied approximately 50% of his total time. It is obvious that this hampered his efficiency in the other areas of electrical maintenance on a statewide basis.

IV. SAFETY DEVICE MAINTENANCE

GENERAL

There is a growing number of activities that are being assembled in this "catchall" area of safety device maintenance. Any traffic maintenance activity that is safety related and does not fit specifically into the sign, marking and signal areas is assigned to the safety device area. In spite of the fact that the Safety Device Engineer shares his work time with the Underwater Inspection Team of the Structure Maintenance Unit he has made steady progress in establishing efficient operational foundations for the activities assigned to this sub-unit.

The following is a report of the pertinent action in the safety device area during the past fiscal year.

A. Impact Attenuators

It has become increasingly evident that District 8 (Boston

area) is not sufficiently staffed to conduct an adequate program for Hydro-cell Maintenance. The Hydro-cell Units are the attenuators that are liquid filled and when they are struck the controlled release of the fluid absorbs the energy of the impacting vehicle. If these units are not refurbished following the intial hit each following hit inflicts increasing damage.

To alleviate this area of maintenance deficiency a contract was awarded to Transpo-Safety of New York to maintain these units for a 12 month period. The estimated cost of this work is $72,000.00. The final cost will depend on how many of the units are struck by vehicles during the year. This work will be partially funded by the Federal Highway Administration.

On a statewide basis the Traffic Maintenance Unit prepared a proposal to supply crash attenuator parts to the Districts so that state forces can replace damaged components after impact. The cost for these parts is estimated at $90,000.00. This money is allocated by the Governor's Highway Safety Bureau.

B. BREAKAWAY BARRICADES (DEMONSTRATION PROGRAM)

The Traffic Maintenance Unit purchased and fabricated type III construction barricades out of PVC Pipe on an experimental basis under agreement with the FHWA. The FHWA funded this project to determine the feasibility of using this type of barricade on construction and maintenance projects. Even before the full evaluation was completed on this project this type

of barricade was already being incorporated into active projects.

The Maintenance Unit had some reservations about people stealing the components of these barricades since the joints are only wedged together and all of the components are excellent for sanitary sewer work. However, after talking with other States that have experimented with this type of barricade it seems that thievery can be reduced by drilling a ½" hole in each joint and section of pipe. This renders them useless for plumbing work.

The barricades fabricated by the Maintenance Forces are currently being used in Districts 3, 4 and 6.

C. SAFETY EQUIPMENT FOR PERSONNEL

The Safety Device Engineer continued the program to protect the members of the paint crews from the hazardous solvents being used in the pavement marking painting area.

This work included periodic urinalysis exams for those members of the crews in direct contact with the solvents, a series of training sessions for all paint personnel which demonstrated the proper use of protective equipment, and continued negotiation with a Public Health Hospital to have the men take physicals to determine if any overexposure exists.

Approximately $5,000.00 in personal protective equipment has been purchased for the paint crews. This equipment includes chemical splash goggles, organic respirators, poly-vinyl gloves, protective skin cream, chemical air detectors, and solvent splash aprons.

This program generally conforms to the OSHA guidelines for worker protection in areas having paint solvents (Toluene Heptane) in the atmosphere.

If the use of paint for pavement marking continues, the personnel protection equipment will continue to be an annual expenditures. There is no reason to think it won't continue, but it would be a welcome development if less toxic materials could be developed for this work. Between the paint heating burners in operation on the paint machine and the toxic constituents of the paints and solvents, the pavement marking operation is one of the more potentially hazardous maintenance operations.

V. PAVEMENT MARKING MAINTENANCE

A. FORCE ACCOUNT ACTIVITY

The pavement Marking materials account was increased from the $640,000.00 in Fiscal Year 1977 to $840,000.00 in Fiscal Year 1978. This amount allowed for the purchase of sufficient materials to keep the Department's pavement marking fleet in operation during the 1978 season.

Purchases out of the account are made in mid to late Winter of the Fiscal Year and deliveries are scheduled for the early spring so that there is fresh paint on hand when the paint crews begin the spring applications.

Approximately 85% of the pavement marking money was spent on materials for application by State Forces. The remaining 15% was spent on contract work.

The paint was purchased in orange colored 30 gallon drums this year so that the Department can use the drums as channelization devices following their use as paint containers. It will be necessary to purchase reflectorized tape for the drums to complete this conversion.

The Department is now using the 10' stripe - 30' space pattern in all of its pavement marking work. This pattern was introduced by the Maintenance Section two years ago and has proven to be an effective pattern.

With the changing striping patterns and the added responsibility of edgelines on more highways it is evident that a new summary must be made to determine what the total Departmental Pavement Marking responsibility is. The Traffic Maintenance Unit thru the Districts will attempt to update these quantities in the coming year.

B. CONTRACT PAVEMENT MARKINGS

The competitive bidding on contract Maintenance pavement marking work in Massachusetts is intense. This competitive bidding, plus the fact that there are local manufacturers of the binder materials such as paint and thermoplastic, allows the Department to enjoy prices as low as any other state in the immediate east coast area. This competition is so keen that the field inspectors have to be wary of the Contractors cutting corners in their performance.

The Traffic Maintenance Unit again prepared and processed the continuing contracts for the federally funded Pavement Marking Demonstration Program there were a total of seven contracts prepared, one

for each District with Districts Five and Eight combined into one contract . The Department had $780,000.00 appropriated for this work but with the savings from other years available it was possible to program approximately $920,000.00. As previously mentioned the low bid prices for painted pavement markings continues to pleasantly surprise the Department. Some of the early bid openings for this work are showing a 15% to 20% differential (lower) from the estimated bid prices.

Indications are that there will be increasing money available for maintenance type activities, including pavement markings, from the Federal Government in the continuing future. It is certain that if this prediction is correct there will have to be more personnel assigned to the maintenance section who can work up projects from start to finish.

C. EXPERIMENTAL

1. RAISED PAVEMENT MARKERS (TEMPORARY)

The Traffic Maintenance Section participated in a federally sponsored installation of temporary pavement markings in construction areas. As a "Spinoff" of this project some of the markers were installed in the gore areas in front of the impact attenuators. These reflecting markers definitely reduced the number of hits the attenuators received. There is a significant savings if the crashes can be reduced, one of the plastic barrels in the sand barrel type of array costs over $130.00 in place. The unfortunate part of the temporary marker is that it is plowed off the highway in snow removal operations. If it is possible however to attain 8 months of high quality lane delineation

this installation would be feasible. These markers cost about $1.40 in place. They are simply stuck on top of the pavement.

2. RAISED PAVEMENT MARKERS (PLOWABLE)

The Traffic Maintenance Section continued to experiment with the raised pavement markers that are resistant to snow plows. The first of these experiments with the raised pavement markers began in 1971. Various models have been tried. The last installation was made in the fall of 1977 and this model performed very well over the severe winter of "77 - 78". These markers were plowed approximately 120 times and only one complete unit was destroyed out of the 102 installed.

There is increasing interest by the Northern States in what seems to be the only successful plowable raised pavement marker. This marker is being manufactured by the Amerace Corp. of Niles, Illinois.

Although the success of this latest model of the Amerace Corporation's plowable raised pavement marker seems to be successful, the Traffic Maintenance Unit continues to recommend a cautious approach to mass installations until the full impact on the snow and ice operation can be evaluated and until an annual marker maintenance factor can be determined. With the severely reduced maintenance crews and trained staff personnel the Department should proceed cautiously in new development areas.

3. PAVEMENT MARKING REMOVAL

An error in the field application of pavement markings on a construction project gave the Traffic Maintenance Unit an opportunity

to once again experiment with the pavement marking removal processes. Another chemical type of removal was attempted. It was possible to remove approximately 1100 L.F. of 4" wide pavement marking line with the combined chemical and water spray method. It took approximately one gallon of this chemical (Stricel) to remove 80 L.F. of line.

There is much activity by industry to come up with the most efficient form of line removal. The most common systems are chemical, grinding, sand blasting and burning. All leave room for increased efficiency. A contemplated demonstration of burning the lines off has been cancelled due to a poor demonstration of the equipment in Washington D. C. Pavement marking removal remains to be much more costly than pavement marking application.

4. PAVEMENT MARKING TAPE

Pre-formed pavement marking tapes have been used for several years by the Department but because of their high cost compared to paint (20¢ LF.vs. 2¢ L.F) they have been used sparingly.

The 3M Co. has now developed a tape that they say will compare to Thermoplastic for reflectivity and durability. An extensive experimental installation of this product is presently being installed on Route 128 in an alternating pattern with thermoplastic. This will definitely show comparable durability and reflectivity characteristics.

The cost of this new tape is $1.00/L.F. installed compared to 25¢ per L.F. for thermoplastic.

The Traffic Maintenance Unit has an experimental installation of the 3M tape on one crosswalk in Middleboro and although it outwears ordinary paint the snow plows and studded tires wear the product out at

isolated sections along the line.

It does not seem that pavement marking operations can justify the high price of this product but perhaps other advantages can overcome this drawback.

A big advantage of the tapes is that there is no clean up, no toxic constituents, no dry time to worry about and the application equipment is economical.

The tape application if successful and if reasonable priced would solve many of the current operational problems in the pavement marking industry.

Another location where this conformal tape is going to be used by the Traffic Maintenance forces is in the Dewey Square Tunnel. This section of roadway has a concrete surface where traditionally paint and thermoplastic have a difficult time with adherence.

5. THERMOPLASTIC

Although thermoplastic is the so called "permanent" pavement marking material being used by the Department, the Maintenance Section continues to experiment with variations of this product. These changes consist of both material variations and application variations.

As a result of some thin thermoplastic lines (thin thickness) that were placed in 1977 it was decided to advertise a contract to compare the durability of the thin thickness lines and the standard thickness thermoplastic lines. Results of this experiment will be reported in next year's annual summary.

6. PASS & NO PASS ZONE LAYOUT

The Pavement Marking Engineer spent many work hours in Fiscal

1978 attempting to process a contract to electronically lay out the passing and no passing zones on various state highways. It was a most frustrating contract to process because of delays that seemed to occur from the beginning of the work.

His persistant efforts finally resulted in the award of the contract for approximately $87,000.00 that is being funded by the Governor's Highway Safety Bureau.

Many worthwhile benefits will come from this work. Some of these are:

I. Graphic Maps showing the passing and no passing zones for individual routes.

2. The total amount of traffic lines required to stripe a route (linear feet).

3. The percent of grade of the roadway every 50 feet.

4. Recommended speeds for curves.

5. 16 electronic distance measuring devices so that the Districts can reproduce the pass - no pass zones.

D. EQUIPMENT

There does not seem to be any other area of Traffic Maintenance that depends so much on equipment repair as the pavement marking operation.

Much of this equipment is specialized; the truck mounted hot paint machine is a good example of this. It seems however that one or more of these machines are broken down all of the time

The operating personnel are performing maintenance above and

and beyond what one would term preventive maintenance. The reason for this is that truck mounted hot paint machines are constantly experiencing operating difficulties and the Department apparently chooses to run the Wellesley Maintenance Depot in a woefully undermanned condition.

It is frustrating to the maintenance personnel and is hazardous to the traveling public when paint machines are not ready to operate until June when the season starts in April.

Although the personnel at the Equipment Shop attempt to stay ahead of the repair to pavement marking equipment it will continue to lose this battle unless more qualified personnel are added to the repair staff.

4. FEDERAL AID PURCHASE HIGHWAY HARDWARE

In 1977 the FHWA decided to extend Federal Highway participation to those items that are constantly destroyed by vehicular impact, due to their proximity to the highway surface.

The Maintenance Section was able to program the following funding for the associated categories:

a)	Purchase of Traffic Signal Bases	$ 61,000.00
b)	Delineator, Mile Markers and 1/10 Mile Marker	$112,000.00
c)	Guardrail Posts	$107,000.00
d)	Breakaway Sign Posts	$112,000.00
e)	Motorist Aid Call Boxes	$105,000.00
f)	Impact Attenuators	$ 74,000.00

The same program was repeated for federal fiscal year 1978 which overlaps the state fiscal year. The limited experience of using the federal monies to finance "Highway Hardware" during this past year and a half indicates the following:

I. Some of the items are more suitable to contract work, some to force account work.

2. Some improvement must be made in the Departments method of accountability for the items being used under this program. The FHWA wants to know where the items were used and if the Department collected any reimbursable funds for the unit being replaced. If reimbursable funds were collected the FHWA wants their percentage of the collection; this is understandable.

3. The Traffic Signal base procurement is particularly suitable to force account installation.

4. Most other items are more suitable to the contract type of project. The reason for this centers around the accountability problem.

A Resident Engineer is usually in charge of the contract type of project whereas the accountability for force account hardware relies on various people such as storekeepers, foreman and the field worker.

5. Little use has been made of the guard rail posts that have been purchased for force account installations. This is due to the insurance contractor repair arrangement that exists in most Districts. The guard rail purchases should be

dropped from the highway hardware program.

In general, the funding to replace highway hardware that has suffered vehicular impact (this program) shows much hope for the future if the FHWA continues their present trend to assist states in maintenance areas. It will just take a little while to establish the "ground rules" and refine the programs for peak efficiency.

SUMMARY

The main complaints issuing from most maintenance units traditionally center around lack of personnel, equipment or money. Traffic Maintenance is no exception, however there are certain areas of Traffic Maintenance operations where, with Federal Assistance, the money problems are being overcome. There still are major shortages in personnel and certainly there are major defiencies in the equipment area. It is hoped that as maintenance of the highway system increases in scope, the administrators will try to keep the personnel equipment and funding in some sort of reasonable balance.

From the foregoing it can be seen that the Traffic Maintenance responsibility within the Maintenance Section is rapidly expanding to meet the needs of a more demanding traveling public. It is also rapidly expanding to meet the needs of each and every new traffic control device that is introduced to the highway system. It was only a few years ago that call boxes, crash attenuators and tower lighting were dreams of designers; today they are demanding maintenance.

In addition to the engineering personnel shortages and field crew shortages, a critical problem is developing at the foreman level. The demands for accountability, reports and record keeping are increasing in seemingly geometric proportion to this new work being proposed. Practically all of this field data responsibility is ending up on the Foreman's work load. The large amount of time being spent on reports is significantly reducing the supervisory activity of the foreman. What is needed is qualified clerical help for the Foremen in the reporting and record tasks.

In spite of the operational weaknesses mentioned in the foregoing the Traffic Maintenance Unit in Boston and the District Traffic Maintenance organizations continue to efficiently maintain the traffic control devices under their responsibility, to the extent that available resources allow.

EQUIPMENT

The following pieces of equipment were purchased during Fiscal '78:

DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
Power Sweepers	8	$32,100.00	$256,800.00
Power Mowers	4	$10,998.62	$43,994.48
Front End Loaders	8	$23,777.79	$190,222.28
Pickup Trucks	34	$4,359.61	$148,226.74
Dump Trucks (1 Ton)	12	$7,592.58	$91,111.00
Utility Trucks	10	$6,286.50	$62,865.00
Dump Trucks (Large)	34	$28,267.23	$961,085.90
Mobile Radio Units	56	$1,013.29	$56,744.00
Power Mower Attachments	2	$1,189.00	$2,378.00
Steam Cleaner	1	$3,691.66	$3,691.66
Lubrication Unit	2	$5,750.00	$11,500.00
Tow-Behind Spreaders	2	$5,699.00	$11,398.00
Wood Chippers	2	$8,291.00	$16,582.00
Vehicle lifts	2	$3,996.00	$7,992.00
Catch Basin Cleaner Attachments	2	$1,231.00	$2,462.00
Sump Pumps (For Catch Basin Cleaner)	8	$438.00	$3,504.00
Small Mowers	2	$5,680.00	$11,360.00
Syncho-Sensors	40	$1,250.00	$50,000.00

GRAND TOTAL $1,931,917.06

TWO-WAY RADIO COMMUNICATIONS

The Department's Two-Way Radio Communication Network licensed by the Federal Communications Commission and operated and maintained by Maintenance Personnel in accordance with the provisions of Part 89 of the Commission's Rules, regulating conduct of the Highway Maintenance Radio Service, continued to provide an efficient means of communications during the routine and emergency activities of the Department during the year.

NETWORK COMPOSITION

At the present time the network consists of the following units:

A. 1 Monitor Control Station
B. 10 District Base Stations
C. 6 Microwave Links with Related Terminals
D. 10 Auxiliary Base Stations
E. 6 Auxiliary Civil Defense Stations
F. 2 Emergency Portable Stations
G. 525 Mobile Stations in Cars and Trucks
H. 32 Citizen's Band Portables and Related "Walkie Talkies"
I. 12 Monitor Receivers for Storm Emergency Message Reception.

RADIO FREQUENCY CHANGES

The final phase of the mobile 4 channel use plan was completed in fiscal 1978 by conversion of District 8 so that 47.14 MHz is their primary frequency. This is in accordance with F.C.C. authorization and the Department's plan to minimize system self jamming by the use of additional frequencies assigned to the Department after extensive coordination with the American

RADIO FREQUENCY CHANGES (CONT).

Association of State Highway and Transportation Officials Radio Frequency Advisory Committee. The coordination was conducted by the Communications Unit under the supervision and direction of The Deputy Chief Engineer, the Maintenance Engineer and higher authority.

The advantages of this frequency reorganization were most apparent in the blizzards of the past winter when car to car, and car to base radio, were literally a matter of survival for many stranded motorists and provided an efficient medium for cost and equipment control.

ADDITIONS TO NETWORK

The General Electric Co., was determined to be the low bidder on replacement and addition of 56 mobile units. Forethought in planning has provided all management personnel with multi-channel capabilities so that they are now able to communicate by radio to all points while in interdistrict travel status.

General Electric was also the low bidder on the new radio console designed to specifications prepared by the Communications Unit. Its installation will insure state wide car and base monitoring and communicating capability with all cars and stations to the Headquarters Communications Unit.

The old console, still in very good condition, will be transferred to Wellesley Depot for use as a back up to the main system. It is planned to provide an alternative link via MCDA Framingham and Wachusett to the micro wave back bone system for use when the

ADDITIONS TO NETWORK (CONT.)

major storm center develops at Wellesley Depot.

The matter of auxiliary power supplies for Mount Wachusett and Boston was in part resolved by airlifting in the generator at Princeton. Ecological factors have slowed progress at Nashua St., but studies indicate that portable use as needed is a possibility.

The Boston firm of Electrocom Inc., representing Wescom Inc., microwave manufacturers was adjudged to be low bidder on the 2GHz microwave replacement for the existing channels to and from Mount Wachusett. This will add a capability of approximately 100 channels to our network and enable the Department to accommodate other State Agencies seeking to tie into a micro-wave back bone system to the west. Consultations have been held with Environmental Affairs and members of the State Public Safety Council Sub-Committee on Communications, regarding extensions to Lincoln and Greylock by equipment and site cooperative trade offs. The Commonwealth will thus gain ecologically and economically, by slowing the proliferation of antennae in otherwise rustic settings, by speeding up and improving communications and providing alternatives to some of the present more expensive means of interdistrict connections.

RADIO MAINTENANCE CONTRACTS

With characteristic foresight, in Fiscal 1978, plans were made by the Maintenance Engineer and a training program implemented by the Equipment and Communications Engineer to provide support for licensed Contract and Department technical personnel in each District in the removal and partial installation of mobile

RADIO MAINTENANCE CONTRACTS (CONT.)

radio units. Substantial savings in time and contract funds with a concurrent decrease in "off the air" time are being accomplished by this program.

The radio tower maintenance contracts were revised and updated to cope with F.C.C. and F.A.A. tower lighting and marking requirements in the vicinity of airports and to insure against more than normal elemental attrition.

Assistance was provided by the Maintenance Communications Unit in the preparation of radio maintenance and repair contracts in order to insure uninterrupted communications to the Districts by assuring the services of a reputable contractor in each District.

The afore said radio maintenance personnel continued to perform preventive maintenance and emergency repairs on Department radio equipment with priority being given to base station operations. "Outs" and operating costs were kept at a reasonable minimum.

Forethought in the procurement of Gersch and Cushman Frequency Meters continued to repay the Department's investment by producing certifiable primary frequency measurements acceptable to the F.C.C. and provided positive assurance against "drifts" into other assigned areas of operation. Use of the equipment eliminated reliance on a contract service with consequent savings and increased efficiency in operations.

AIDS TO NAVIGATION

In accordance with Department policy, the Communications Unit at Nashua St., continued to provide assistance to boatmen

AIDS TO NAVIGATION (CONT.)

in alerting lock and draw personnel by telephone to insure timely passage of navigable streams in accordance with U.S. Coast Guard Regulations.

RADIO FREQUENCY COORDINATION

In accordance with a request from the American Association of State Highway Officials, the Deputy Chief Engineer for Highway Maintenance agreed to serve as member for Massachusetts on the AASHTO Subcommittee on Communications, whose function is to coordinate applications for frequency allocations in the Highway Maintenance Radio Service and local Government Radio Service with the Federal Communications Commission and other Public Safety Radio Service Committee and users.

While the fuction of the indicated Subcommittee is advisory and does not bind the Commission or the applicant, the Commission states in its Rules and Regulations that, in its absence, proof of notification and concurrence to all co-channel and adjacent frequency users within a radius of 75 miles or a costly engineering survey must be provided with the application. In the course of the Fiscal Year 115 applicants availed themselves of this Public Service, either on their own behalf or through an authorized coordinator in the Public Safety Radio Service. It was particularly gratifying that the Department received a letter of thanks from the storm damaged Town of Hull for our assistance in procuring radio frequencies in this public service operation.

EMERGENCY COMMUNICATIONS

In accordance with Legislative Mandate and Department Policy, the two way radio network of this Department was coordinated with the State and Federal Civil Defense Agencies. Consultation was also held with the Department's Liaison Engineer at M.C.D.A. and Communication Dispatchers instructed in reception of information from severe storm spotters whose field observations are transmitted via the Nashua Street Radio Room to M.C.D.A.For Further Transmission to Logan Airport via "NAWAS".

The Department's Auxiliary Civil Defense Network consists of Base Stations licensed to operate on Department Frequencies and located as follows: It functioned very efficiently from State Control at Framingham during the winter blizzards.

1.	State Control		Framingham
2.	Area	1-	Tewksbury
3.	Area	2-	Bridgewater
4.	Area	2-	Sector-(2C)-West Dennis
5.	Area	3-	Westborough
6.	Area	4-	Belchertown

The emergency communications net, which was established to provide a liaison apparatus with the United States Bureau of Public Roads, the Emergency Broadcast System, and related Federal Agencies in the Boston area for the relay of Federal Defense Conditions messages continued to be maintained on a standby basis.

EMERGENCY COMMUNICATIONS (CONT.)

The fog alerting procedure initiated by the Maintenance Engineer and developed by the Snow and Ice Control Staff continued to operate during Fiscal 1978. This procedure requires members of the Communications Unit to contact the State Police by an ALL POINTS Teletype Bulletin when a forecast is received predicting foggy conditions. Upon receipt of confirmation from the State Police of the development of fog to a Hazardous driving condition, the Maintenance Engineer or his designees alerts State Forces via the Communications Unit to take appropriate warning action in the foggy areas, thereby safeguarding the traveling public; and the Department against liability in these matters.

Mobile operations are conducted by the use of the State-Wide Network authorized in the Department's license for the call sign KA-8171 and there is a mobile station for this Department in the Civil Defense Mobile Station van.

SNOW AND ICE CONTROL

The removal of snow on State Highways is carried out under the authority of Section 19, Chapter 81, of the General Laws as amended.

The activities of the Snow and Ice Control Unit include; responsibility for proper performance of plowing snow, the judicious spreading of chemicals to keep snow plowable and sand for added traction, the clearing of waterways, winter patrolling of certain structures, the clearing of signs and signals, the strategic placement of snow fences along State Highways, post-winter cleaning of highways and catch basins, and the acquisition and improvement of maintenance sites.

During the 1978 Fiscal Year, the Department plowed and treated 11,611 lane miles of State Highways.

The Storm Emergency Center's communication with several key State Agencies and surrounding cities and towns during the past winter was considerable. During the prior eight (8) winters, this Center, whose additional function is to facilitate access to and from the core city, was used effectively on many occasions. Last winter can be characterized as very severe, with several small storms and two major storms that reached blizzard proportion. The first major storm occured over January 20 and 21, 1978. This storm dumped up to twenty-five inches of snow throughout the state, and although the storm was severe, clean-up operations proceeded smoothly with no major tie-ups occuring.

The second and heaviest storm has been characterized as a "100 year storm" and was the worst storm suffered by the Northeast Region in modern history. This storm began at about 8:00 AM February 6, 1978, and reached blizzard proportions at about 4:00 PM the same day, dumping upwards of two inches of snow per hour during the peak of rush hour traffic. This storm was accompanied by Hurricane force winds and an extensive tide abnormality, over four feet above mean, which produced considerable coastal damage and flooding.

The main brunt of the blizzard struck in northwestern Norfolk County, in totality depositing thirty-six (36) inches of snow in that area. Stranded motorists and abandoned vehicles caused the closing of many major arteries, the worst being Rte. 128 from Rte. 9 to Rte. 138 with upwards of 3500 vehicles left trapped in the wake of the storm. Rtes. 138 and 95 in that area and Rtes. 9 and I-495 in Worcester County also became plugged as the storm progressed. Rescue of stranded motorists began immediately and continued through the evening as many different Agencies banded together in fighting this storm.

The blizzard continued through the evening and showed no sign of abatement until early the next morning. The Govenor declared a State of Emergency late that evening and an extensive driving ban was in effect for all municipalities east of Worcester for most of the week. The monstorous clearing operation began that morning, and over 2800 pieces of equipment were utilized in opening highways and removing abandoned vehicles. All state highways were finally opened by midday, Saturday, February 11, 1978, and assistance was given motorists in retrieving their vehicles which had been towed from the travel way. A complete treatise has been prepared by all Agencies involved in the snow removal

operations during this blizzard and can be obtained from the Department's Public Relations Office.

In Fiscal Year 1978, Cargill, Inc. prosecuted a contract for 12,000 tons of Pre-Mixed Sodium and Calcium Chloride in the ratio of four parts Sodium to one part Calcium Chloride by weight at a cost of $43.75 per ton. The use of this compound has proved to be most effective in combating icing conditions and snow storms in sub-freezing temperatures as the Calcium Chloride provides a catalytic action for the Sodium Chloride at much lower temperatures and affords a more sustained brine on the roadway. In addition to the Pre-mix, 178,966 tons of Sodium Chloride, at an average cost of $19.25 per ton and 183,023 tons of sand, at an average cost of $2.75 per ton was applied.

The contract construction of Chemical Storage Sheds was completed with the remainder of the $3,000,000.00 1976 Fiscal Year Accelerated Highway Program appropriation from the Legislature. These sheds, which range from sixty(60) feet to ninety-six (96) feet in length, varying in twelve (12) foot increments, all forty (40) feet in width now total one hundred five (105) statewide, Electrical lighting supplies along with bituminous concrete to provide a four (4) inch thick flooring and an approach apron outside, was issued from the money for all one hundred five (105) of these sheds and installed by Department Forces.

The chemical storage sheds constructed, now totalling one hundred seventy-one (171), provide eighty (80) percent coverage of all chemical used for snow and ice control. This, then, gives the Department one hundred percent (100%) permanent covered storage on land that the Department now owns; the remaining twenty percent (20%) of the chemicals is being stored on land occupied by the

Department, either by sufferance or lease, preventing permanent structures to be erected on these lands. On these non-Department owned areas, chemicals are stored on Bituminous Concrete pads covered by Department issued polyethylene sheeting.

Another multi-year appropriation providing $2,000,000.00 for the "Acquisition and Improvement of Maintenance Sites" from the 1977 Accelerated Highway Improvement Bonding Authorization gave the opportunity for many needed betterments. These improvements included installation of electricity, sewerage and water to our depots, the levelling and grading of sites and the chain link fencing needed to enclose these sites for safety and as a safeguard against vandalism. This funding has also allowed the Department to continue closing on its objective with the Program for the Acquisition of Maintenance Sites.

Chapter 356 of the aforementioned Acts also provides one million ($1,000,000.00) dollars to be made available to cities and towns in the Commonwealth for the construction of chemical storage sheds. This money was enough to construct by contract only thirty-six (36) buildings, administered by this Department and according to Department Plans and Specification. The thirty-six municipalities involved were selected, after field investigations, as having the highest level of sodium pollution in their drinking water supplies. The criteria for sodium pollution determination was based on the sodium level of twenty (20) parts per million, established by the Executive Office of Envirmental Affairs.

Contract catch basin cleaning and highway cleaning was resumed this year

with the issuance of one year contracts. Twenty-three (23) separate contracts, costing a total of $251,208.00 for the cleaning of catch basins along State Highways Statewide were let this past fall season. During this past spring, thirty-seven (37) separate contracts were prosecuted for the cleaning of State Highways, at a total cost of $690,286.00.

The experiment in evaluating the importance of surface temperatures over the known air or ambient temperatures was continued. This year, based on data previously recorded, Weather Services, Inc., of Bedford, the consulting meteorogical service to the Department, has continued their experimental prediction of asphalt surface temperatures in the Route 128 belt during the winter months. Accuracy of this data is still being compared with the actual temperatures measured from the heat sensitive probe, which was installed in Route 128 previously, in correlation with data collected from the instrument package (which includes an annemometer, an ambient temperature thermometer, a pyrograph and a relative humidity gauge) at the same location.

The defense against dense fog's sudden development on high speed roadways leading to multiple accidents has been advanced by improved warning system. Weather Services, Inc., still has written into their contract provision for such forecasting in addition to their usual forecasting services and agreement has been reached with the State Police for observation pursuant to warnings of potential fog development. Department Forces are then alerted for placement of warning devices when conditions deteriorated.

Representation from this Unit was mandated at Task Force Meetings on

Snow and Ice Control during this past Fiscal Year. These task force meetings were set up by Commissioner Carroll and include representatives from other State Agencies, i.e.; Metropolitan District Commission; Massachusetts Turnpike Authority; the MBTA; Public Health; Executive Office of Environmental Affairs, etc.; along with environmental groups and concerned citizens. The intent of these meetings is to review the snow and ice control policies of the different State Agencies, providing information when necessary and to assimilate complaints and suggestions made for possible changes in Department policies. Approximately fifty hours of this unit's time was made available for research and meetings of this task force.

The Snow and Ice Engineer is a member of the Transportation Highway Research Board Committee on Snow and Ice Control.

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BUREAU OF TRAFFIC OPERATIONS

1978

BUREAU OF TRAFFIC OPERATIONS

As the construction of our major arterial system reaches completion, the role of the Bureau of Traffic Operations has increased.

The Bureau has placed considerable emphasis upon highway safety in F Y 1978.

Not only has there been great emphasis placed upon improved safety on our Interstate and State Highway systems; the Bureau has also initiated sound practical programs on the local level.

In Fiscal Year 1978 the Bureau continued to make a contribution in the reduction of energy consumption.

REGULATIONS UNIT

The basic activities of this Section have been:

a. Drafting and reporting proposed legislation

b. Advice to cities and towns on regulations

c. Responding to court summonses of Department records

d. Processing Permits for School Zones and reimbursement of the cost to municipalities.

e. Reviewing Traffic Control Agreements

A large number of legislative Bills was reported on this year. However, there was unusual activity in the areas of truck dimensions, Right Turn on Red, and the requirement to yield after stopping at a Stop Sign.

SPEED REGULATION UNIT

The Speed Regulation Unit has continued monitoring vehicular speeds on our state highways for the Department and Federal Highway Administration. Quarterly reports have been submitted to the F.H.W.A. showing the average speed, median speed and 85th percentile speed of motorists.

Technical traffic engineering advice was given to cities and towns to aid them in their preparation to obtain Special Speed Regulations.

FEDERAL HIGHWAY SAFETY UNIT

The Federal Highway Safety Unit, in cooperation with the Governor's Highway Safety Bureau and Federal Highway Administration, continues to administer programs under the 1966 Highway Safety Act (Section 402 - 3 1/2 Standards) and the most recent Safety Act passed by Congress (1976 Highway Safety Act), respectively.

The following is a synopsis of work done in these programs:

1966 HIGHWAY SAFETY ACT
GOVERNOR'S HIGHWAY SAFETY BUREAU

The Governor's Highway Safety Bureau administers a program by which both cities and towns and the Department receive funds for various safety related equipment and activities.

Standard 609 - Identification and Surveillance of Highway Accident Locations. The Accident Records Group continues to maintain the Department's Computerized Accident Records System. The Photologging Unit maintains a picture file of a major portion of the State Highway System and Numbered Route System.

Standard 612 - Highway Design, Construction and Maintenance. The Bureau is funding both impact attenuator parts and the permanent national railroad-highway crossing identification signs.

Standard 613 - Traffic Engineering Services for Communities. Department engineers assist cities and towns in applying for funding assistance for pavement stripers, traffic counters, regulatory, warning and school signs, impact attenuators and vacuum applicators, as well as engineer training. Department engineers administer a limited engineer training program for Department engineering personnel.

Standard 614 - Pedestrian Safety. There is no funding for this program.

Section 203 - Railroad-Highway Grade Crossing Program. Funds are obligated for both surface rehabilitation and signal protection at numerous at-grade railroad-highway crossings throughout the Commonwealth. The unit works with the Utilities and Federal Aid Sections in administering this program.

Section 205 - Pavement Marking Demonstration Program. The Maintenance Section, in conjunction with the District State Aid Offices, expends these funds by advertising contracts yearly for pavement marking statewide.

Section 209/210 - High Hazard Locations/Elimination of Roadside Obstacles Program. Various safety jobs were advertised by Highway Engineering, Maintenance, and the Bureau of Traffic Operations.

Section 219 - Safer Off-System Roads Program. The unit advertised three contracts for regulatory, warning, and school signs with breakaway supports for forty-five (45) communities in Districts 1 to 5.

SIGNAL & LIGHTING UNIT

The Signal Unit has been involved this year in Signal Updating Programs, Design Projects, Processing of Designs by Others, Design Reviews, and Issuance of Permits as described below:

Signal Updating Programs

There are two programs in operation this year:

1. Updating of 33 State signal locations in 24 cities and towns to comply with the Uniform Manual of 1971. These locations were identified as top priority for updating by the Signal Inventory generated last year. The updating is being designed by Department personnel and reviewed by the Signal Unit at the 75% and 100% levels. The Signal Unit processes the projects for advertising. Work is presently at the 25% level and will

be advertised in Fiscal 1979. Funding is approved for $500,000.00. This is a good beginning to reducing the backlog in compliance with the M.U.T.C.D. for State signals.

2. Updating of 29 Municipal signal locations in 16 cities and towns to comply with the Uniform Manual of 1971 and to eliminate the use of the combined red/yellow pedestrian indication. These locations are designed by the city or town with the assistance of the Department and reviewed and processed by the Signal Unit as described under the State Update Program above. Work is presently at the 25% level and will be advertised in Fiscal 1979. Funding is approved for $500,000.00 this year to aid in reducing the backlog in complying with the M.U.T.C.D.

In-House Signal Designs

The Lord Overpass, Lowell signal project was constructed and accepted during FY 1978.

The Lowell, Towers Corner project, involving signals, lighting, parking, lot and part was advertised and started construction during FY 1978.

The I-93 Carpool Lane Extension Project; including new signs, markings, lane use signals, lighting and barriers, was brought to the 100% design level during FY 1978.

The Marlborough-Hudson Rt. 85 signals project (in conjunction with highway design) was at the 25% level in FY 1978.

In-House Expediting of Signal Designs

Ten projects originating in the districts with construction to be monitored by Maintenance were processed by the Signal Unit. Processing includes obtaining Project Review approval and design review. The projects and their status are listed below.

1. Foxborough - Rte. 140 @ State Hospital - designed, advertised & awarded.
2. Boylston - Rte. 140 at Rte. 70 - designed, advertised & awarded.
3. Haverhill - Rte. 125 @ S. Riverview & Old Boston Rd. - 100% design level.
4. Taunton - Rte. 44 @ Longmeadow Rd. - 100% design level.
5. Revere - Bennington, Winthrop, State Rd. - 100% design level.
6. Lawrence - Exit 33 off Rte. 495 - 100% design level.
7. Dracut - Rte. 113 (Lighted Curve signs) - designed and advertised.
8. Tewksbury - Rte. 38 @ Chandler St. - 25% design level.
9. Woburn - Washington St. - Study approved by project review committee
10. Springfield - Berkshire, Boston, State St. - 25% design level.

Design Review

The Urban Systems-Safety Improvement Programs were continued in 1968 along with State Aid Programs. The Signal Unit reviewed designs on about 100 different projects covering some 350 intersections from consultants and the Districts. Many of the projects were reviewed at more than one level (i.e. 75% & 100%) and some contained lighting as well as signals.

Signal Permits and Standards

Approximately 150 permits for city and town signals were processed during this year. Work was also done on updating our traffic signal standards and drawings. A new procedure for design reviews was also issued to provide better information on the need for new or updating of signals.

The Lighting Unit has lead and participated in Energy Conservation and Lighting Conversion, High Mast Lowering Device Retrofit, Night Time Paving, Construction Seminars and Technical Consulting during this year as described below.

Energy Conservation and Lighting Conversion

The Lighting Unit has continued the energy conservation program which has been in effect for the past three years. A strict application of the Department's highway lighting warrants was continued, insuring that lighting was being installed only in areas where it was required for safety reasons. The conservation program was expanded when the Federal Highway Administration reversed its earlier position and agreed to fund the conversion of existing mercury vapor lighting systems to high pressure sodium vapor. This allowed the Department to process a conversion contract for most of the existing lighting in District #2 and to commence design work for the other Districts. The lighting industry announced the development of a 200 watt HPS lamp during this fiscal year. This new lamp was incorporated into our ongoing conversion program, thus increasing the average energy saving realized by the conversion program to 50% from the previously available 37% saving.

Retrofit of High Mast Lowering Devices

The experimental installations of high mast lowering devices conducted in the previous fiscal year have led to a retrofit program where the existing, somewhat unreliable lowering mechanisms are being replaced with a more sophisticated, high, dependable device. The first retrofit contract, covering 77 units on Interstate Route 91 in District #2, was awarded in October, 1977.

Night Time Paving

The Lighting Unit prepared lighting specifications, provided technical advice and field supervision for an experimental nighttime paving operation on Route 128 in Burlington. The operation consisted of paving 4000' of eight lane highway at night with intense illumination

in the work areas and somewhat lower illumination in the lane drop areas. The experiment proved to be successful, and is expected to lead to mandatory nighttime paving operations on all high volume roadways.

Construction Seminars

During the winter months the Lighting Unit participated in a series of construction seminars, advising the resident engineers of the methods and procedures to be followed in constructing and inspecting electrical systems.

Technical Consulting

A number of lighting designs prepared by consulting firms were reviewed by the unit. In addition, electrical shop drawing review and approval and technical advice during construction were provided by the unit for approximately 12 major roadway projects which were under construction during the fiscal year.

TRAFFIC SIGNS & PAVEMENT MARKINGS

A review of fiscal year 1978 shows that the Sign and Pavement Marking Unit has devoted its major effort to the review of signs and pavement markings for Urban System and Interstate Design Projects: 34 Interstate Project Reviews and 108 State Highway and Urban System Project Reviews. These reviews take place at the 25%, 75% and pre 100% stages. There were also 4 Interstate projects designed by this unit updating the signs for Interstate 95 (Route 128).

In addition this unit also reviews the construction warning devices necessary to provide maximum safety to motorists using the facility while it is under construction. Devices include warning signs, temporary pavement marking barrels and barricades.

All signs fabricated by the Wellesley Sign Shop must be reviewed and approved by this unit. For the most part the legend and sizing of the sign panel is calculated in this section.

A new service provided by this unit is in the supplying of Sign Face Shop Drawings for construction projects designed in-house. This service involves use of the computer-plotter. A coding sheet is prepared for the Computer Section, which then provides this unit with the shop drawings. These drawings are then forwarded to the Contractor, District, and Research & Materials.

As the need for new sign legend becomes apparent, this unit provides the new message in concise language. During fiscal 1978 this unit designed 45 new signs.

During the past year only one route change was made rerouting Route 60 to terminate at Bell Circle in Revere.

The Sign Unit, working with the City of Boston and the Federal Highway Administration, reviewed signing for a new concept in establishing an Auto Restrictive Zone (ARZ) within the central shopping area of Boston.

Several times during the past year this Unit was called on to work with the Construction Unit to review detours and provide adequate signing for its implementation.

Administration of the Service Sign Program providing information to the motorist needing gas-food-loging is an on-going function of this unit. During fiscal 1978,4 new applications were processed. Periodically the warrants governing the approval of the service signs were violated requiring the removal of the signs.

For many years the only P-5 breakaway sign support was the Unistrut Post. During fiscal 1978 this unit conducted studies and recommended approval of a new P-5 Post manufactured by Franklin Steel Company. A recent contract dramatically showed the benefits of this new competition by reducing the price of this P-5 post by 40%.

Stricter compliance with laws governing outdoor advertising prompted the Administration to develop a Pilot Commercial Signing Program. The location selected for this Pilot Program was Route 7 which is located in the Western Section of the Commonwealth and begins at the Connecticut State line and proceed north to the Vermont State line.

The Sign Unit developed policies for implementing this Program. Initially 10 commercial enterprises were selected and approved for participating in this Program. The first signs were erected in January of this year. To date six of those selected have agreed to abide by the policies adopted and have had signs erected. Further study is necessary to properly evaluate the merits of this Pilot Program.

RESEARCH & MATERIALS SECTION

Materials Testing
- Bituminous
- Chemical
- Concrete
- Soils

Field Materials Control

Soils and Foundation

Research Unit

ANNUAL REPORT FOR FISCAL YEAR 1978

RESEARCH & MATERIALS DIVISION

The Research and Materials Division has its headquarters in Wellesley and is responsible for a wide variety of physical research projects and for complex materials testing.

MATERIALS TESTING SECTION

One of the Division's major components is the laboratory. For testing and detailed analysis purposes, this is divided into four units, as noted:

1. Bituminous: quality control of bituminous materials and bituminous concrete mixes. The testing and evaluation of new products.
2. Chemical: paint, chlorides, pesticides, adhesives and many other products are analyzed.
3. Concrete: portland cement and concrete are tested as well as reinforcing steel, brick, pipe and fencing materials.
4. Soils: earth materials - gravel, sand, peat, loam, etc. are analyzed.

BITUMINOUS UNIT:

The responsibilities of this unit as in the past years, were both the routine control testing and investigation of bituminous materials, mixes, pavements and other related materials which are utilized in the Department's construction and maintenance projects.

The bituminous unit is subdivided into two sections for the efficient handling and testing of liquid, semi-solid bitumens and bituminous concrete mixes.
During the past year, this testing unit continued to use the low temperature ductility test and other pertinent AASHTO tests to evaluate the quality of asphalt cements being supplied to the various State projects. Investigational work was performed on open graded "Popcorn" bituminous pavements; the use of recycled pavements; bottom ash in pavement mixes; and the feasibility of Silo storage mixes. The bituminous unit also performed various cooperative tests and demonstrations for several of the asphalt suppliers in order to secure consistent test procedures between testing laboratories.

The Bituminous Unit's Test procedures and equipment, as in the past years, met the requirements of the AASHTO Materials Reference Laboratory periodic inspection. Due to the lack of sufficient personnel, the amount of testing was curtailed to a "spot check" method which enabled us to test approximately 800 samples during the past fiscal year.

CONCRETE UNIT:

The primary function of the Concrete Unit in past years has been the quality control testing of Portland Cement Concrete and its

individual components; viz. cement, fine aggregate and coarse aggregate. Subsidiary functions include the evaluation of reinforcing steel, bricks, blocks, various types of conduits and pipes, admixtures, proprietary related products and various coatings for cement concrete.

In recent years an added group of items, fencing materials, has been added to the Concrete Unit for evaluation and routine testing. In addition, a Federally sponsored research program (R-30-0) has continued into the formulation and use of Polymer Concrete which necessitated the training of 5 department employees at Brookhaven National Laboratories into the intricacies of the unstable chemicals involved. Many field installations have been made to test the feasibility and properties of the polymer materials. A technical sound movie on the Polymer Concrete Research was made at a studio in M.I.T., which was presented to the Transportation Research Board in Washington, D.C. in January 1978. Routine research was performed on a large number of proprietary patching compounds and grouts, both with fast and normal setting times.

This unit continues to check cooperative samples with the National Bureau of Standards. At the present time these samples number approximately twelve; consisting of 4 concrete, 4 aggregate and 4 cement samples per year.

The Concrete Unit continues to be periodically inspected by the Cement and Concrete Reference Laboratory of the Nat. Bureau of Standards (ASTM) and the AASHTO Materials Reference Laboratory (AMRL of AASHTO). This represents an increase over previous years and the complexity of the tests has increased the time required in the testing of many of the items. The total number of samples tested last year number approximately 8,000.

SOILS UNIT:

The Soils Testing Unit's primary function is the quality control testing of Soils, Soils Aggregate, and other related materials. Examples of materials are gravels, ordinary borrows, embankment materials, bridge foundation materials, sands, impervious materials, loams, peats, and other related materials.

The Soils Unit follows all AASHTO Test Procedures to make sure that the department receives specification materials for its highway construction and maintenance projects.

Specifications and American Standards for nursery stock are used for our Department Roadside Beautification Program.

In addition to our regular testing we have a working agreement with the U.S. Soil Conservation and the U.S. Geologic (groundwater and geologic) Survey for testing and classification in connection with research projects. For Massachusetts there is also related Geologic and Soils and Foundation testing and field work that must

be done. Samples tested for department and related organizations amount to about 550 samples. The Soils Unit is also working with the following agencies - University of Massachusetts, Mass. public Health, Dept. of Environmental Management in research for the use of Bottom Ash in construction and Metro Loam for beautification in Roadside Development.

CHEMICAL UNIT:

The Chemical Unit continued its primary assigned responsibility which is the testing and evaluation of a great variety of materials used in the work of the Department. This responsibility includes materials used in the construction and maintenance of highways. A secondary responsibility is the evaluation of materials used in maintenance of the Department's vehicles and equipment. Examples of the former are the testing of the following materials; paints, reflective sheeting, deicing chemicals, protective coatings, adhesives, glass beads, herbicides, joint sealers, wire and cable, concretes, etc. Examples of the latter material are: Motor oil, fuel oil, hydraulic oil, equipment enamel, etc.

Other functions of the chemical unit are as follows: Performs evaluation studies for the Product Evaluation Committee. Performs in-house research on paints and protective coatings and is responsible for the continuing update on paint and protective coatings to take advantage of new technology. Serves as a consultant to Department Engineers regarding the use of protective coatings

and various corrosion problems. Serves on various sub-committee of AASHTO and ASTM in the writing of new specification and test methods on a national basis. Analysis for Roadside Beautification project and testing of epoxy compounds for concrete repairs. Environmental responsibilities includes: Performing chemical analyses of water from wells, ponds, lakes, reservoirs, rivers, streams, roadside runoffs and runoffs at construction sites. Assist environmental division in conduction air and noise pollution studies. In addition to the above, a bridge deck evaluation and inspection unit operates out of the Chemical Unit. It's responsibilities consist of training and assisting district teams in the area of bridge deck corrosion chloride content and membrane evaluation, and chloride analysis of all samples taken by District personnel. Advice is also furnished district personnel on maintaining their inspection equipment.

FIELD MATERIALS CONTROL SECTION

The Field Materials Control Section has the responsibility for the monitoring of the plants which manufacture products used in highway building. There are more than two hundred bituminous concrete, cement concrete, and aggregate processing plants in and out of the State, which at one time or another, service Department projects. Their manufacturing equipment, techniques and controls must be approved by this unit.

Other manufacturing plants, such as steel, prestressed concrete, pipe, catch basin and manhole block companies must also be inspected and their products approved on a regular basis . In addition to their plant monitoring, this Unit is responsible for all progress and final record sampling on Federally Aided construction projects and is also charged with detailed review of materials documentation on these projects, and final certification to FHWA.

SOILS AND FOUNDATION SECTION

TEST BORINGS:

Six advertised boring contracts totalling $361,700 were advertised in Fiscal 1978 as follows: Route I-391 Chicopee, Routes 3, I-93, and 128 Quincy - Braintree, Routes I-495, 290 and Route 95 Connector, Route 140 Gardner - Westminister, and open end contracts for 1978-Districts 1, 2 & 3 and 4 through 8. The Department's two open-end boring contracts had thirteen projects, Districts 1, 2 and 3 had 7 projects and Districts 4 through 8 had 6 projects.

The Department's test boring crew completed 17 projects in Fiscal 1978. In District 1, 2 and 3 there were 4 projects and in Districts 4 through 8 there were 13 projects. Due to the limitation of the equipment and whereas the Department has only one crew, it is necessary to use contractors to complete the larger test boring programs.

Design Bearing Ratio was obtained for 11 projects throughout the State. Sub-grade materials were tested by the California Bearing Ratio Method to obtain a Design Bearing Ratio which is used by the Pavement Design Engineer to determine the pavement requirements for the Department's layered pavement design.

Several soils reports submitted by consulting engineers were reviewed and comments forwarded to the Design Section.

Several well studies for Right of Way were done on domestic water supplies affected by construction.

The Soils and Foundation Laboratory performed all the necessary testing for the Soils and Foundation Unit which consisted of Gradation, Classification, California Bearing Ratio, Atterberg Limit and Organic content tests.

SOILS ENGINEERING, RESEARCH AND FIELD INSTRUMENTATION

This unit continues to review the technical aspects of all soil reports submitted for proposed department work, to ascertain that the designs and construction methods are in the best interest of the Department. This often involves a site visit; and where special problems occur, is followed up by construction inspection.

Upon request, this unit performs geotechnical investigations, analysis and/or design for the other divisions of the Department.

This work consists of outlining preliminary and design stage sub-surface investigation programs; outlining laboratory testing programs; analysis of boring information and laboratory test results; and based on the preceding information making design calculations and recommendations usually in the form of a geotechnical report submitted to the appropriate division.

This unit also continues to work on two HPR Research Studies that are coordinated by the Federal Highway Administration through the office of Research and Development.

The two studies are:

1. R12-7 "Evaluation of the Freezing Soil Heave Stress System".
2. R12-9 "Full Depth Testing of Frost Susceptible Soils".

The latter study has received national recognition; various agencies have expressed much interest in the work that is being done here. The study involves the field investigation of frost action in various soil type subjected to similar environemtal conditions. The field test is located in the Department's Maintenance Depot off Route 202 in Winchendon and after one Winter of operation the test shows evidence of being very successful.

MATERIALS SECTION

Approximately 35 construction projects were visited by the embankment and Soils Field Control Engineer to check on material incorporated in construction embankments. The Nuclear Density Gauge continues to be a valuable piece of equipment in determining density and moisture content for soil as well as for Bituminous Concrete. With the introduction of manufactured crushed stone and dense graded crushed stone for sub-base, the Nuclear Density Gauge has become an invaluable piece of equipment to measure density and compactive effort.

SKID TESTING

During the 1978 fiscal year our Skid Testing Program was continued in three separate phases.

First, an inventory program was continued to test and catalog the entire state highway system, with the interstate highway system receiving first priority to be followed by primary and secondary roadways.

As of this time approximately 50% of the entire state highway system has been tested.

The second phase of the program involves testing of new and/or experimental pavements shortly after being placed, with periodic remeasuring in order to monitor the change in skid resistance and to evaluate the mix design, wearing qualities of various aggregates, etc. Approximately 500 lane miles were tested on this basis.

The third phase is testing areas on the basis of special needs, such as high wet accident areas. Approximately 100 lane miles were tested on this basis.

Also, during this period bids were received for the purchase of a new Skid Testing Unit and a Mays Ride Meter. A low bid of $74,677 was submitted by K.J. Law Engineers for the skid testing unit and a low bid of $14,570 was submitted by Rainhart Company for the Mays Ride Meter.

RESEARCH UNIT

During the past fiscal year the Research Unit was responsible for the supervision of eleven studies under the Highway Research Program which is financed in part by the Federal Highway Administration. In addition to these we continued two other studies on a 50-50 basis with U.S. Geological Survey; one of these is the Geologic Study and the other is the Water Resources study. The following is a list of the Highway Research Program Studies which were active during fiscal 1978.

Study No.	Title	Research Agency
R-5-5	Roadside Development	University Of Massachusetts
R-9-0	Hydrologic Study-small Watersheds	U.S. Geological Survey
R-12-7	Evaluation of Rapid Frost Susceptibility test for Soils	Massachusetts Department of Public Works, Research & Materials Division

R-18-0	Effects of Deicing Chemicals upon Surface and Ground Water	U.S. Geological Survey & Massachusetts Department of Public Works
R-21-3	Reduction of Negative Skin Friction	Massachusetts Institute of Technology
R-27-0	Surface Characteristics of Pavements	Massachusetts Department of Public Works, Research & Materials Division
R-30-0	Evaluation of Bridge Patching Materials	Massachusetts Department of Public Works, Research & Materials Division
R-31-0	Evaluation of Internally Sealed Concrete	Massachusetts Department of Public Works,Research & Materials Division
R-35-0	Bridge Deck Bituminous Overlayment	Massachusetts Department of Public Works,Research & Materials Division
R-40-0	Management Control System	Massachusetts Department of Public Works,Maintenance

The research program has proven to be most beneficial,resulting in improvements in the following areas of highway design, construction, (including materials testing) and maintenance:

R-5-5 Utilization of new and available materials for providing an attractive and stable cover for roadside development.

R-9-0 Devising a more economical hyrdaulic design of highway drainage structures.

R-12-7 Evaluation of rapid frost susceptibility test for soils to allow more readily available and cheaper materials to be used in frost free highway bases and sub-bases.

R-12-9 The purpose of this project is to study various soil types under similar environmental and natural freezing conditions. The results of this study hopefully, will aid in the development of test procedures for the classification of soils with reference to relative frost susceptibilty.

R-21-3 The primary objective for this research is to develop methods by which negative skin friction may be reduced economically, and to develop bases for predictions leading to comprehensive design methods that will minimize the downdrag loadings.

R-18-0 The study to determine "The Effect of Deicing Chemicals on Surface and Ground Water" is expected to lead to improved methods of snow and ice control which in turn will have the twofold benefit of improved winter driving safety and minimal adverse effect on the environment.

R-27-0 A major objective of the study of surface characteristics of pavements is the development of improved methods of cataloging the highway system with reference to skid resistance and present serviceability. Ultimately this will lead to the ability to predict the need for resurfacing of highways and improved procedures for design and construction of friction courses and pavements in general.

R-30-0 This study will be directed toward the development of actual on the job procedures while researching the effects of varying proportions of various polymer concrete mixtures. A secondary objective will be to determine operational costs as compared to standard Bridge Patching procedures taking into account disruption of traffic and related motorist inconveniences.

R-31-0 The objective of this study is to investigate the practicality of using an internally sealed concrete overlay as an exposed concrete wearing surface of a bridge deck. This concrete surface will be sealed internally by adding wax beads to the concrete during mixing after curing the concrete in a conventional manner, the concrete overlay will be heated to melt the wax, causing it to flow and fuse into the capillaries of the concrete, thus internally sealing the overlay.

R-35-0 The objective of this study is to: 1 - develop a practical system for removing and replacing a bituminous overlayment on a bridge deck without damaging the existing waterproofing membrane 2 - To design a replacement overlayment to have sufficient stability to resist distortion that may be caused either by the stresses that are induced by sudden changes in traffic velocity or by slippage of the overlayment due to the grade.

R-40-0 The objective of this research project is to adapt and implement a management system appropriate for the Massachusetts Department of Public Works through which highway programs may be selected, planned, organized, directed, controlled and evaluated.

PROCEDURES & RECORDS SECTION

PROCEDURES & RECORDS SECTION

The P&R Section is responsible for the continuous, comprehensive and systematic review of the records, policies and procedures relative to the technical operations performed by organizations reporting to the Chief Engineer.

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I. MAJOR ACTIVITIES

A. Construction Compliance

Engineering Teams from this Section conducted approximately one hundred twenty (120) in-depth reviews of active Highway & Bridge Construction Projects throughout the Commonwealth. The review consists of a circumspect inspection and audit of all records relating to documentation for pay quantities and control of materials and equipment incorporated into the project to assure that the project is in compliance with Contract Specifications, Department Standard Operating Procedures and other controls; and render assistance where required. This phase of the review is followed by a field inspection of work completed and in progress, in company with the Resident Engineer. Various construction operations underway are observed to sssure that accepted practices and controls are being maintained by State personnel and those of the Contractor. Where applicable, Check measurements are taken to ascertain conformance with Specifications. In addition, the Contractor's overall compliance with OSHA (Occupational Safety and Health Act) requirements are evaluated with particular emphasis placed on safety measures exercised by the Contractor to provide protection for all employees on the project and traveling public.

I. MAJOR ACTIVITIES (cont)

Detailed reports of these reviews are prepared together with any recommendations and submitted directly to the Chief Engineer, with copies distributed to Research & Materials Division, Construction Office, the respective District, and to the Division Office of the Federal Highway Administration.

In addition to review of all facets of the project relating to construction, the format for the Project Review Report includes EEO Project Compliance with particular emphasis placed on compliance with required record-keeping, report submissions and includes an in-depth progress summation of the status of On-the-Job Trainees for those projects containing this Special Provision as part of the contract. An additional copy of each report is distributed to the Section's EEO Unit to keep them informed of the overall compliance pattern and advised of any potential problem areas.

B. EEO - External (Contractor) Compliance

Responsibility to assure contractor compliance with equal employment opportunity, non-discrimination and affirmative action was delegated to the Procedures & Records Engineer and Section by his designation as Department EEO Coordinator. The Section, and in particular, the EEO Unit (EEO Administrator and Assistants) have developed procedures to implement and review compliance as follows:

1. Federal Contract Provisions - Preconstruction Conferences are held for every Federal Aid Project, and personnel from the EEO Unit were present at over one hundred (100) conferences to provide instructions and clarification to contractors and department personnel regarding both Federal and State contract provisions and policies.

I. MAJOR ACTIVITIES (cont)

The Section analyses the Resident Engineer's Monthly EEO Reports (every active Federal Aid Project).

The Section analyses the Construction Compliance Reports (see "A. Construction Compliance").

Approximately forty-five (45) On-Site EEO Project Compliance Reviews were conducted statewide by the EEO Unit over the past year. In addition, five (5) Contractor Home Office EEO Reviews and three (3) Special Reviews were conducted. These reviews were made both independently and in conjunction with personnel of the Division and Regional Offices of the Federal Highway Administration.

Over the past year, Contract Special Provisions on certain Federal Aid Projects have stipulated assignment of On-the-Job Trainees (a total of 85). As set forth in the contract, prior to start of construction, the Contractor must submit his selection of trainee classification(s) and then his proposed training program for approval by the Department EEO Coordinator. Following review and approval, the program is forwarded to the FHWA Division Administrator for concurrence.

During this fiscal year, three (3) minority-oriented organizations, located in New Bedford, Lawrence and Boston, were employed as Consultants to provide Supportive Services to On-the-Job Trainees in the Consultant's respective geographical area. These services relate to recruitment, development of good work habits, counseling, follow-up, etc. In addition, a new contract was effected to employ a Consultant to furnish supportive services to established and/or potential minority contractors and subcontractors, and promote in-

I. MAJOR ACTIVITIES (cont)

creased participation of minority business enterprises in Federal-Aid Highway Construction Programs. One hundred percent (100%) federal reimbursement is received for the direct services provided, but time expended by Section personnel in monitoring the work and processing of invoices are absorbed by the Department.

The Special Provision relative to Minority Contractor participation developed by the Section and others has been adopted by the Federal Highway Administration on a national basis. The provision provides for prime contractors to contact minority contractors and extend to them an equal opportunity to negotiate subcontracts.

2. State Contract Provisions - The Section is the designated agent of the Massachusetts Commission Against Discrimination (MCAD) for assuring compliance with the State Affirmative Action Program (mandating minority manhour goals). Prior t o commencing construction and each three (3) month period thereafter, every contractor is required to submit Projected Quarterly Manning Tables which reflect his goals in complying with required minority employee ratio in each job classification on his project work force. These submissions are reviewed, analysed and approved together with subsequent Weekly Manpower Reports submitted by the Contractor and all subcontractors for the duration of the project. Failure to meet goals in any classification results in the contractor being reported in 'Apparent Non-Compliance' to the Mass. Commission Against Discrimination in the Section's monthly Affirmative Action Compliance Report.

I. MAJOR ACTIVITIES (cont)

The Minority Contractor Provision (Set-Aside) implemented by the Department on five (5) pilot projects in Fiscal 1977, was only the second State Highway Agency (with FHWA support and concurrence) to develop and utilize Special Provisions for Minority Subcontract Set-Aside participation (2% - 4% of project value). Following the success of the initial five (5) projects, the Department implemented Phase II of the Set-Aside Program with a target of ten (10) additional projects (selective) during Fiscal 1978. Compliance with this provision is being monitored very closely by the Section.

C. Statistical Reports

The Section has the responsibility for compiling and processing the ever-increasing work load of statistical reporting requirements for the Department in the area of EEO and Civil Rights, to satisfy both State and Federal requirements.

D. Civil Rights - Title VI Guidelines

The overall responsibility for initiating and monitoring Title VI (1964 Civil Rights Act as amended) activities has been assigned to the Procedures & Records Engineer and the Section. The Section is responsible for monitoring the compliance with these guidelines in conjunction with the designated Civil Rights Officer in each of the nine (9) Federal Aid Program Areas, and submission of an Annual Summary Report of Compliance. This program is involved in ensuring that no one in Massachusetts is denied the benefits of; excluded from participation in; or subjected to discrimination under any Federal Aid Program.

I. MAJOR ACTIVITIES (cont)

E. Standard Operating Procedures

Over the past year, the Section completed its assignment of coordinating the up-dating of the Department's Standard Operating Procedures, as directed by the Chief Engineer, for all Bureaus, Divisions, Districts and Sections. The SOP Manual was instituted in 1967 and had not been reviewed nor updated in its entirety since that time.

The Section continues to review all proposed new or revised Standard Operating Procedures concerning engineering or technical operations of the Department. Where necessary, investigations are conducted to provide clarification of procedures or enunciation of policy.

II. SPECIAL ASSIGNMENTS

In several areas, this Section is involved on a continuous basis for special assignments:

A. Construction Seminars - The Procedures & Records Engineer and other Section personnel participated in the annual meetings with field personnel in each of the Districts throughout the State.

B. Construction Safety - Occupational Safety & Health Act (OSHA) regulations are prominently featured in Construction Project Reviews. In addition, the Section maintains close liaison with the Division of Industrial Safety, Mass. Department of Labor & Industries.

Section personnel are available for investigative assignments by the Chief Engineer to resolve problem areas.

III. LIAISON WITH OUTSIDE AGENCIES

A. Federal Highway Administration - In addition to formal contact with the FHWA Division and Regional Offices, personnel of this Section have continued to participate in Seminars and Workshops conducted at Regional and National levels.

B. AASHTO & AHONAS (NASHTO) - The Procedures & Records Engineer has been an active delegate to these organizations of State Highway Officials. Over the past year, initial preparations have been completed for Massachusetts' serving as Host State for the 55th Annual Meeting of NASHTO (North Atlantic States Highway Officials) which will be held in Hyannis on April 24, 25 and 26, 1979.

C. Other States - Acting as Liaison for the Chief Engineer and Commissioner, this section has prepared replies to general and specific inquiries from sister states, particularly in the area of Equal Employment Opportunity.

D. Other Departments/Agencies - Via meetings and correspondence, the Section has maintained liaison with the Massachusetts Commission Against Discrimination; Department of Labor & Industry, Department of Commerce & Development, Massachusetts Turnpike Authority, Metropolitan District Commission and the Division of Administration & Finance.

E. Contractor Organizations - A productive relationship of mutual benefit continues with CIM (Construction Industries of Massachusetts) and AGC (Associated General Contractors).

F. Unions - The cordial relationship with Highway Industry Trade Unions, through meetings and correspondence, continues relative to Equal Employment Opportunity.

III. LIAISON WITH OUTSIDE AGENCIES (cont)

G. Minority Organizations - Civil Rights and EEO duties have involved the Section with minority organizations throughout the Commonwealth. The productive relationships established have proven to be beneficial to all parties of our contracts.

DATA PROCESSING SECTION

Equipment

System Development

Equipment

At the beginning of March 1978 an IBM 370/148 computer system was installed in the Data Processing Section replacing the IBM 370/145. The new computer, which is considered to be in the medium-size range, has twice the memory capacity (one million characters) and forty percent more computing speed than its predecessor - the 370/145.

During the first nine months of 1978 there were 56,310 jobs processed through the computer. This reflects a very large amount of computer processing and in order to accommodate this demand it was necessary to upgrade the computer capacity.

The larger capacity increases our multi-programming capability, i.e. the computer can now process more jobs simultaneously and thereby increase job throughout and provide faster service to the computer users.

A new data entry system was installed in December of 1977. This is a key-to-disk system which replaces most of the keypunch equipment and reduces the need for punched cards by about seventy-five percent. The key-to-disk system provides a much faster and efficient data entry service. The keypunch bottleneck has been relieved.

System Development

A job accounting system has been implemented which provides a detailed description of the computer resources used by each job that is processed. With this information available it is possible to feed pertinent data into the Federal Aid Billing System. Negotiations are now underway with FHWA to establish computer usage for federal aid projects as a reimbursable item.

An Accounts Receivable System is under development. This system will provide a means of keeping an automated accounting of payments received by the Department for fees, rents, sale of land and buildings, grants and other items. A master file will be established for all accounts which will be updated on a regular basis. This file will provide the data necessary for preparing many and varied reports showing the status of each account. It is also planned to have the system prepare a computerized bill for most accounts.

Several innovations have been made to the Personnel System. There are two files which are maintained for this system - a position file and a personnel file. Each file is updated as needed. Pertinent data is continually added to this file to accommodate the various reports required by the Personnel Office. The system now provides the seniority report for permanent employees and a vacancy report showing each vacant position. It also provides special reports for maintenance personnel within each maintenance foreman's section.

The Maintenance Management System officially went into effect July 1, 1978. The computer end of this system had been under development for about two years and there is still a substantial programming effort going on to improve the editing of data and the accuracy of reports. The data supplied by the maintenance foreman are input to the system from the district office via a teleprocessing terminal. The computer edits the data and sends a message back to the district terminal should any data corrections be required. Data entry from the data source, namely the district, provides an efficient method for correcting input data errors.

The Traffic Accident Analysis System has been programmed to automatically provide the coordinates for an accident location. This is done by searching a file of previous accidents to find an accident that occurred in the immediate vicinity and computing coordinates from that point. This saves the manual effort required to locate coordinate points on maps for about 90% of all accidents required.